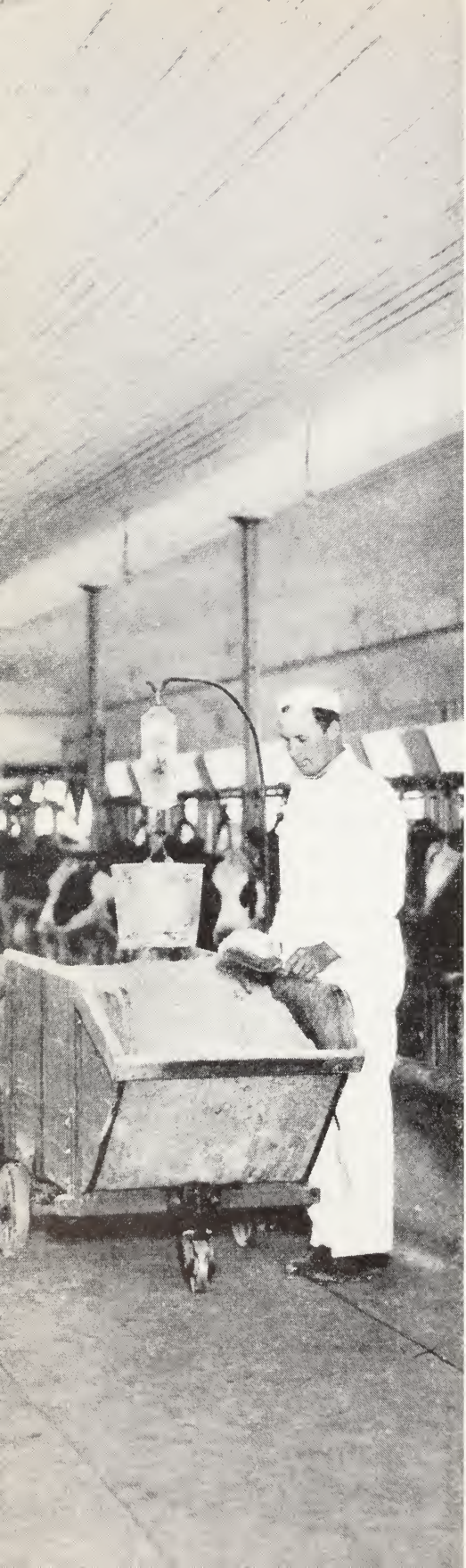
Division of Agricultural Sciences
UNIVERSITY OF CALIFORNIA

california DAIRY FARM management

ARTHUR SHULTIS G. E. GORDON

CALIFORNIA AGRICULTURAL
Experiment Station
Extension Service

CIRCULAR 417
REVISED



CALIFORNIA is in a healthy condition so far as dairy products are concerned. It is a deficit area with more dairy products shipped in than are shipped out; and its dairies have a high production efficiency, partly because of abundant high-quality dairy feed. Nevertheless, a dairy farm in California is an intensive enterprise, existing on high-priced land and given over exclusively to dairy farming. As in all intensive farming, the capital investment is high, and the operating costs can become very high unless good management practices are applied consistently.

THIS CIRCULAR, which is concerned with profit-determining factors, describes the good management practices involved in each. The records are from many successful dairies throughout the state. Since feeding practices are the most important items in both production and expense, how to get the best feeding program at the lowest possible cost is considered in detail. This information is of value to the established dairyman and the sometime dairyman as well.

THE AUTHORS:

Arthur Shultis is Agriculturist, Agricultural Extension, and Associate on the Giannini Foundation, Berkeley.

G. E. Gordon is Agriculturist, Agricultural Extension, Berkeley.

DAIRYING AS A BUSINESS . . .

is an important enterprise in California

Dairying, in value of its products, is one of the most important single agricultural enterprises in California and the most widely distributed over the state. In 1954, milk was the major source of income for about 12,450 farms. In 1957, the California Crop and Livestock Reporting Service estimated an average of 868,000 cows milked (table 1). These produced 7,708 million pounds of milk. Cash received from sale of dairy products in 1957 was $355,938,000, or 13 per cent of the total value of farm products sold. Dairymen, in maintaining their herds, also produced and sold a substantial number of cattle and calves. Cows and surplus calves from dairy herds contributed a considerable portion of the state's supply of beef and veal.

TWO TYPES OF MILK

Milk from California farms is sold as market milk or as manufacturing milk. The proportion of market milk, which has been increasing steadily in recent years, passed the 50 per cent mark in 1943 and was about 76 per cent of the total in 1957.

Market milk. Milk produced and sold under the strict sanitary requirements of state and city laws and regulations for fluid milk and cream is called market milk or grade-A milk. It brings a higher price than manufacturing milk, but requires better buildings and more equipment for cooling and handling. A dairy so equipped, and selling the major part of its milk for this purpose is called a market-milk or grade-A dairy.

Minimum prices of fluid milk to producer, and of market milk and cream to retailer and consumer, are determined according to state law by the Bureau of Milk Control of the State Department of Agriculture in 33 marketing areas covering the state. The average milk-fat content of market milk was 3.70 per cent for the state as a whole in 1957. Payment is according to schedules for fat and skim milk. Market milk is usually sold to distributors under a contract specifying the quantity or percentage of total production to be paid for at class-I milk prices. This varies widely for individual dairymen. In 1957, 80 per cent of the grade-A milk was of class-I usage, the surplus being paid for at lower prices.

Manufacturing milk. All milk other than market milk is called manufacturing milk. In California most of it is now sold as whole milk for the manufacture of evaporated milk, dried milk, cheese, and butter. A small amount of farm-separated churning cream is still sold in this state (around 1.6 per cent of the total manufacturing milk fat) and it is included in manufacturing milk.

Manufacturing milk is largely paid for at separate prices for the milk fat and the skim milk. Since prices of manufactured dairy products are determined largely by supply and demand conditions for the country as a whole, the California manufacturing-milk producer competes with dairymen all over the country. Although manufacturing-milk production and number of creameries are declining in California, the manufacturing-milk producer can still find one or more outlets for his milk in most of the state.

SPECIALIZED DAIRY FARMS

Commercial production of either main type of milk in California is mostly on specialized dairy farms that produce little else than all or part of the roughage

Table 1: California Dairy Cows, Production, and Value of Milk

Period or year	Cows milked, average for year	Average production per cow		Commercial milk-fat production			Market milk	Average price per hundredweight		Cash farm income from milk, excluding subsidies
		Milk	Fat	Total	Market milk	Manufacturing milk		Market milk	Manufacturing milk	
	thousands	pounds	pounds	million pounds	million pounds	million pounds	per cent	dollars	dollars	thousand dollars
Prewar 1937–1941	687	6,796	260	166.4	74.8	91.6	45	2.30	1.64	92,615
War—4 yr., 1942–1945	772	7,000	270	191.2	105.3	85.9	55	3.90	3.38	175,558
Postwar, 1946–1950	798	7,390	288	216.6	136.5	80.1	63	4.71	3.64	254,283
1951	781	7,700	300	221.5	149.5	72.0	67	5.00	3.97	279,866
1952	793	7,660	289	222.0	153.0	69.0	69	5.64	4.41	320,589
1953	816	8,100	308	240.6	164.9	75.7	68	5.29	3.82	326,501
1954	834	8,410	320	255.1	171.6	83.5	67	4.62	3.18	300,804
1955	847	8,550	325	262.8	179.4	83.4	68	4.61	3.20	313,015
1956	850	8,600	327	264.8	191.2	73.6	72	4.74	3.30	331,410
1957	868	8,880	333	277.2	210.7	66.5	76	4.75	3.37	355,938

used by the dairy herd. The average-sized herd is larger than in any other important dairy state. The 1954 census shows that 17,224 farms in California sold some milk or cream. Allowing for family cows, the average number of cows per farm for these farms was around 45. These account for 98 per cent of the dairy cows in the state. In a number of leading market-milk counties, the average number of cows per dairy is over 100, and in Southern California it is over 200.

Even where a dairy enterprise is associated with other enterprises on a general farm or a fruit farm, it is usually fairly large and handled by special help. Practically all of the cows milked are dairy breeds, with Holsteins predominating.

Despite the highly specialized nature of dairying in California, there are many types of dairy farms. Their wide distribution over the state in areas of different climates, kinds of feed, and cost levels, creates these variations.

In high-cost areas around metropolitan centers only market-milk dairies are found. Some of these are corral or dry-lot dairies where no feed is produced and few, if any, calves are raised. Farther out in the country are dairy farms where part or all of the forage is grown on the farm as pasture, hay and silage.

PRODUCTION EFFICIENCY

Production efficiency for California dairies is the highest for any state in the union. Average production per cow in 1957 was 8,880 pounds of milk and 333 pounds of milk fat per cow, as compared with 6,162 pounds of milk and 235 pounds of milk fat per cow for the United States.

California in January, 1958, was the highest dairy state in number of cows on test, with 252,707 or 29 per cent on test in dairy herd improvement associations, compared with 7 per cent for the United States. Average production per cow for California cows on test was 423 pounds of milk fat, compared with 383 for all cows on test in the entire country in 1956. High production per cow may be attributed in part to climate and the abundant high-quality dairy feed, but more largely to good management.

THE PRESENT SITUATION

California is a deficit area for dairy products; more are shipped in than are shipped out. While the state produces all of its market milk and cream, and more evaporated milk and dried milk than it consumes, it now ships in from other states most of its butter and cheese. The state also is deficit in the production of cows to maintain its milking herds. Approximately 30,000 dairy cows were shipped in from other states in each of the last three years, or 3 per cent of the total.

Use of market milk and other dairy products has been increasing rapidly with California's increasing population, high consumer-buying power, and development of consumer preferences for dairy products. But the number of cows and the amount of milk produced, although increasing, have not kept pace with the total need of the increasing population for all dairy products.

THE FUTURE

Market milk production in California will probably continue to increase to meet the fluid milk needs of our increasing population. Producer prices as set by the state will be at levels to keep grade-A dairymen in business and assure an adequate supply. They may be confident of an opportunity to obtain a fair profit with good management. Whatever the price, there always will be some who produce at a loss, while others make a satisfactory profit. It is doubtful, however, if price and earnings will be high enough to enable dairying to compete with high value field, vegetable, and fruit crops on some of our better-irrigated lands in the Salinas and San

Joaquin valleys. Dairying will tend to concentrate more on irrigated lands suited to a narrower range of crops such as irrigated pasture only.

Manufacturing-milk prices have been rather stable in recent years with a little occasional help from price support purchases by the United States government. Adjustments have been taking place with a decline in number of cows and only a small increase in total milk production for all uses. A small, but gradual, improvement in prices and profit opportunity seems likely over the years nationally. California's deficit situation in the production of manufactured dairy products will continue, offering local manufacturing-milk producers a small price advantage over surplus producing areas in other states. But it is doubtful if profit levels will be high enough to enable competition here with more profitable land uses. Our manufacturing-milk production will continue to decline in total and in per cent of total milk production, with shifts to market milk and more profitable alternatives.

Even though we have just said there are places where dairying of both types may not be as profitable as other types of farming, there are also areas where it can be the most profitable. Dairying has a stability of income and absence of risk, through crop failure or low prices, not equalled by any other type of farming. It offers, in our opinion, a better opportunity to obtain a higher return on managerial ability than crop farming. It offers greater returns in any area than other kinds of livestock farming—even cattle feeding. Anyone who knows and likes dairying, and can obtain an adequate-sized business in the proper place, and who will apply good management, should be confident of success insofar as longtime future prices are concerned.

WATCH NEAR-FUTURE OUTLOOK

Milk and feed prices change from time to time. The dairyman should watch the short-run outlook for opportunities to improve profits or for a warning of a difficult economic period ahead. Once in business, he cannot profitably shift in and out with short-run price changes. But he can improve his chances of success and security by basing his current decisions on the best of information. Much is available from federal, state, and other sources on current trends in prices. The local dairy Farm Advisor of the Agricultural Extension Service, University of California, will have this information, and will be glad to advise in its application.

When the prices of beef and feeds are high in relation to milk prices, it is a good time to sell cull and surplus cows and adjust size of herd to a more economical forage supply. When feed prices are low and milk prices good, it might pay to increase the size of business and buy the extra feed needed. When the outlook for profit is poor, it is important to economize on both business and personal expenditures, and keep the budget balanced to remain financially strong. Constant management is the dairyman's safeguard in bad times and his assurance of higher profit in good times.

CALIFORNIA'S SIX DAIRY REGIONS . . .

extend nearly the entire length of the state

The state may be divided into six major dairy regions. Commercial milk-fat production for the six dairy regions is shown in Figure 1, below. The number of dairy farms, cows, and the amount of production are given in Table 2.

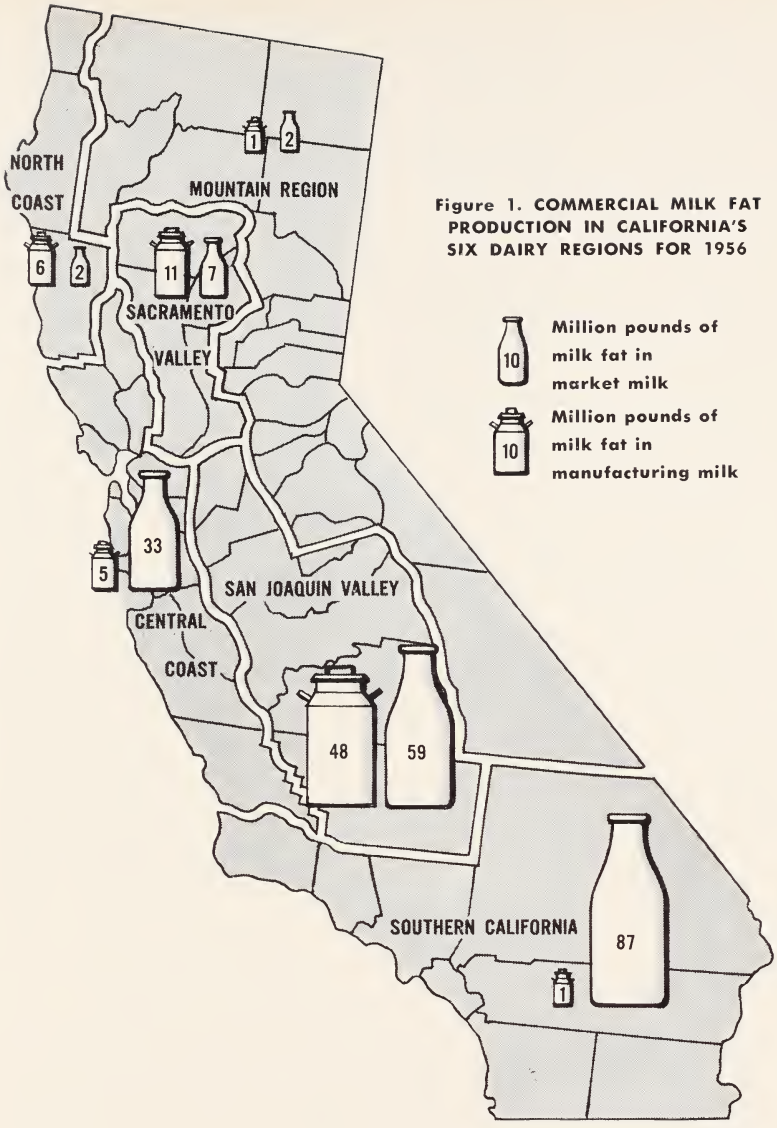


Figure 1. COMMERCIAL MILK FAT PRODUCTION IN CALIFORNIA'S SIX DAIRY REGIONS FOR 1956

NORTH COAST

Dairying here is largely the production of manufacturing milk from the hay, pasture, silage, and root crops in coastal valleys and along the coastal bench. Rainfall is higher than in any other part of the state, beginning earlier in the fall and extending later into the spring, so that natural pasture and hay meadows are very productive. Winters, although mild. are so wet or cold that many fields cannot be pastured. It is usual, therefore. to freshen most of the cows in the spring, making a highly seasonal production. The practice of irrigating is increasing. This prolongs the green-feed season through late summer and early fall. Most of the hay and some silage are produced in this area, although some additional hay is now purchased from outside areas.

Table 2: Dairy Farms, Cows, and Production by Regions

Item	North Coast	Central Coast	Southern California	Sacramento Valley	San Joaquin Valley	Mountain and Northeast	California total
From 1954 Census of Agriculture							
Number of dairy farms	725	1,379	1,105	1,973	6,855	413	12,450
Per cent dairy of all farms	21	6	3	13	18	5	10
Per dairy of all products sold	37	12	15	7	10	6	12
Number of milk cows, 1954	29,217	123,919	203,215	73,736	340,123	20,520	790,730
From California Crop and Livestock Reporting Service for 1956							
Dairy cows 2 years and over, January 1	32,800	144,700	230,000	84,700	411,000	23,800	927,000
Commercial production of milk fat							
Market milk, 1000 lbs	2,238	32,951	87,337	7,189	59,457	2,072	191,244
Mfg. milk, 1000 lbs	6,246	5,421	724	11,499	48,146	1,483	73,519
Total milk fat, 1956, 1000 lbs	8,484	38,372	88,061	18,688	107,603	3,555	264,763
Total milk fat 1950, 1000 lbs	9,439	37,371	66,280	16,739	87,456	3,645	220,930
Per cent 1956 of 1950	90	103	133	112	123	98	120
Per cent market milk 1956	26	86	99	38	55	58	72
Per cent market milk 1950	13	79	99	36	44	52	65

Seasonality by region and type of product 1956	Per cent of monthly average													
	Mkt. milk	Mfg. milk	Mkt. milk	Mfg. milk	Mkt. milk	Mfg. milk	Mkt. milk	Mfg. milk	Mkt. milk	Mfg. milk	Mkt. milk	Mfg. milk	Mkt. milk	Mfg. milk
January	84	23	101	112	100	121	98	82	95	95	101	84	98	88
February	81	31	95	112	94	113	94	82	90	92	90	79	93	86
March	98	91	103	142	100	134	101	102	98	105	98	97	100	106
April	107	140	101	146	99	121	102	117	99	111	101	112	99	117
May	114	166	102	144	100	109	106	130	102	118	107	137	102	126
June	109	158	94	115	96	103	93	125	97	113	103	133	96	119
July	112	148	96	96	99	98	95	121	100	116	107	125	99	118
August	106	129	99	77	100	68	101	113	103	110	100	116	101	109
September	97	106	98	65	97	70	103	96	100	94	94	96	98	93
October	101	91	103	63	103	56	102	87	105	88	99	87	104	86
November	96	69	102	62	103	81	98	75	102	79	96	70	102	76
December	95	48	106	67	108	126	105	71	108	80	102	63	107	75

In the last six years, dairying in the north coast region has shown a slight decline, with market milk increasing from 13 per cent to 26 per cent of the total. Much of the shift to market milk has been in Mendocino County, where it is now about 50 per cent. Market-milk production has increased in Humboldt County, also, but a further increase beyond local needs is not expected soon because of the distance and transportation handicaps in shipping milk to the San Francisco Bay area.

CENTRAL COAST

This long region extends from Sonoma and Lake counties in the north to San Luis Obispo County in the south. The region also includes a few counties away from the coast and, hence, has a range from coastal through semicoastal to interior climatic conditions. Several large, partially irrigated valleys have conditions similar to Central Valley areas.

It is an old and well-developed dairy region but with many shifts and changes in its various parts. Its production is now predominantly market milk for the San Francisco Bay area and other large centers of population. Dairying here has declined in some areas around cities and on land more profitable for vegetables, but although the last six years show a small decline in the number of cows, at the same time there has been a slight increase in milk production. Herds have increased in size, with greater dependence on hay trucked in from the interior valleys.

SOUTHERN CALIFORNIA

Dairying here is almost entirely the production of market milk for the large local population. In this area of low rainfall most crop production depends on irrigation. Land values are high because of high-value fruit and truck crops and pressure of population. Irrigation water is limited and costly in much of the area.

Dairying is being crowded out of many localities by urban development, and is moving into small, intensive areas zoned for this purpose in Los Angeles and Orange counties. Despite these handicaps, production here increased a third in the last six years—more than in any other region (Table 2).

Near Los Angeles. Dairying here consists of the corral feeding of cows with purchased hay and concentrates shipped in from distant producing areas. These corral or dry-lot dairies are unique. They might be called milk factories rather than farms. Few replacements are raised in the congested area, and herds are maintained by shipment of cows from other areas. Yet Los Angeles is not only the leading dairy county in the state but in the nation as well. Production per cow is the highest in the country.

This great dairy development under almost urban conditions is supported by the large consumer market, isolated by mountains and desert from distant areas perhaps better adapted to dairying. Services to dairymen in labor, feed, replacement cows, equipment, and credit are also highly developed here and in part contribute to the high level of efficiency.

In Riverside, San Bernardino, and San Diego counties. Away from the congested area, there are some farm-grown forage crops and irrigated pastures. The use of irrigated pasture, however, will always be more limited than in the interior valley areas of the state.

Imperial County. In the southeast corner of the state there is some dairying on irrigated land under hot, dry conditions. Some years ago, this area produced a considerable amount of manufacturing milk, with alfalfa as pasture and hay the main feed. Alfalfa was used in rotation with high-value crops, and dairymen rotated to some

extent from farm to farm to utilize the alfalfa. In recent years dairying has declined, and about 70 per cent of the present production is market milk for local use and for shipment to San Diego. In the prevailing high summer temperatures, cows produce somewhat less than in more comfortable climates. With low-cost, efficient forage production, greater use of shelters and cooling devices, and wider use of a system of seasonal production, dairying could be efficient and economical. It may increase again if alternative uses of land become less profitable.

SACRAMENTO VALLEY

Milk production increased here about 12 per cent in the last six years. A considerable part of the land in the Sacramento Valley, yet to be irrigated, is better adapted to irrigated pasture than to high-value fruit, truck, and field crops, so dairying will continue to increase. Although still mainly a manufacturing-milk region, market milk increased from 36 per cent to 38 per cent in the last six years, and will continue to increase. Dairying is largely based on irrigated pasture, alfalfa hay, oats and vetch hay, and silage. This area is similar to the San Joaquin Valley, which joins it on the south, but has a narrower range of adapted, competing crops.

SAN JOAQUIN VALLEY

The San Joaquin Valley is the most important dairy region in the state and contains about 14 per cent of the cows. Production here has increased 23 per cent in the last six years, and the proportion of market milk produced has increased to 55 per cent. In addition to supplying market milk for its local population, a large amount is shipped to the Los Angeles and San Francisco areas. Additional shifting to market milk will take place as demand increases.

Dairying in this area is based largely on alfalfa hay, silage, and irrigated pasture. Since it is a large commercial-milk, plus alfalfa-hay-producing area, the local farm value or cost of hay is about $6.00 a ton below the cost to dairymen near San Francisco and Los Angeles. There is also considerable local grain production. Irrigation water for the region as a whole is more plentiful and lower in cost than in Southern California, and irrigated pasture provides economical dairy feed. Alfalfa is also a preferred crop here, in rotation with cotton, potatoes, and vegetable crops.

It is the usual practice in this valley, in both types of dairies, to maintain or increase the herds through raising heifers within the enterprise. There is always some buying and selling, and some of the enterprises raise surplus heifers and even a few bull calves for sale.

Despite the long upward trend in production in this region as a whole, there are shifts and local declines. Irrigated row crops such as cotton, potatoes, and several vegetables, have been more profitable than forage crops and have displaced them on many of the better lands. There has been a decline in manufacturing-milk production and a shift to market milk in the southern counties of the valley; this has resulted in the closing of several creameries. Dairying will no doubt continue to increase in the region, but in the areas less suited to high-value row and fruit crops. It will also become more intensive in some areas and more dependent on purchase of hay from off the farm. There has also been an increase in the feeding of beef cattle in the region, utilizing some feeds in competition with dairying.

MOUNTAIN AND NORTHEASTERN REGION

This region is large geographically but not important agriculturally, since most of it is mountainous and not adapted to farming. Aside from some market-milk production for local use there is little dairying except in the few northern and

eastern counties that join and extend down to the Sacramento Valley. Dairying has been declining in importance in most of the more distant mountain valleys with some shifting to beef cattle.

Dairying in this part of the state is based largely on hay and a combination of irrigated and natural pasture. Winters here are longer and more severe and necessitate a greater use of hay than in other regions. Surplus stock can be raised cheaply here under range conditions for sale in other areas.

DAIRY FARM COMPOSED OF ENTERPRISES . . .

one is dairying—the other, one or more feed crops

An enterprise is each separate crop or kind of livestock produced for the purpose of making a profit. A dairy farming business contains the dairy enterprise and usually one or more related feed crop enterprises; occasionally there are

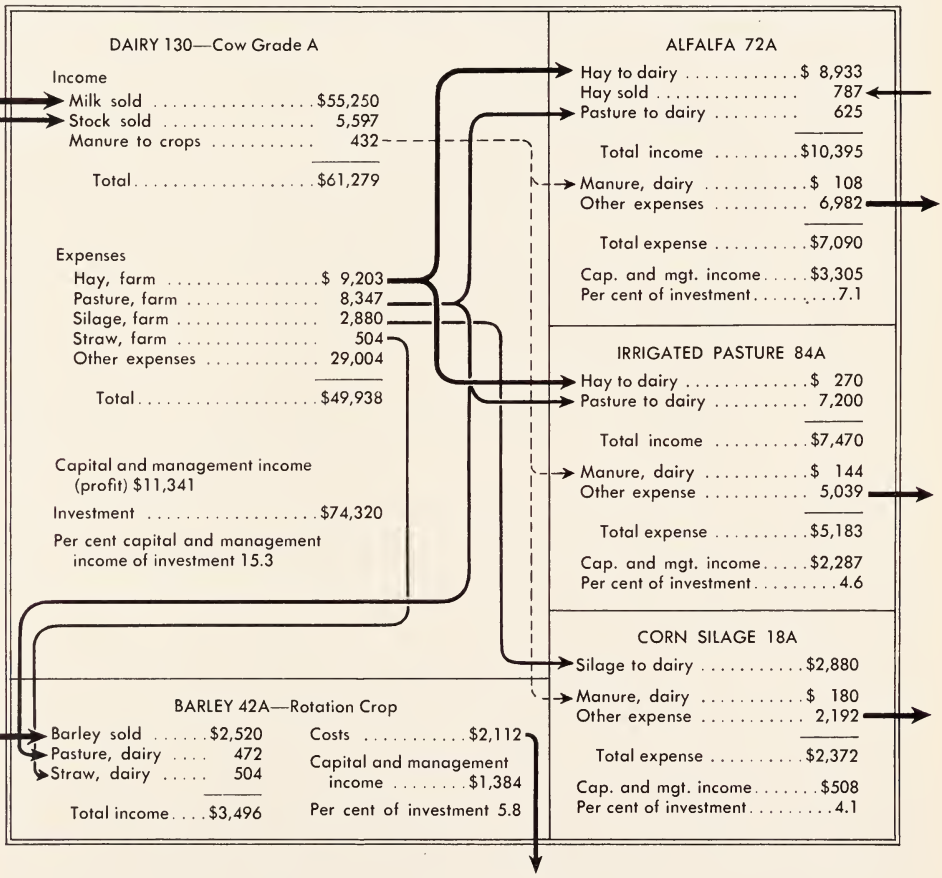


Fig. 2. The above chart illustrates the interenterprise relationships on a sample San Joaquin Valley dairy farm with a dairy enterprise of 130 cows and four crop enterprises of 216 acres. Total farm business had a capital and management income of $18,825 or 9.1% of an investment of $207,340.

additional crops or livestock not related to the dairy. Where the entire business is a corral dairy, with all feed purchased from off the farm, as is found around Los Angeles, it is a single enterprise farm, with the dairy enterprise and the total farm business the same. A dairy farm with alfalfa hay and irrigated pasture, all used by the dairy enterprise, has three enterprises—the dairy, the alfalfa, and the irrigated pasture.

Considering a dairy farm on an enterprise basis helps in discovering ways to improve profits. The hay and pasture are charged to the dairy at current "farm value," which is what they could be sold or rented for on the farm. A dairy enterprise statement is prepared from records and estimates, and will show a profit or a loss. The alfalfa receives the credit for hay and pasture furnished the dairy or sold, and a statement for this enterprise is also prepared to show a profit or a loss. Irrigated pasture has its costs, and the value of the pasturage charged to the dairy is its income. Such an analysis of enterprises shows where the profits and losses are, whereas the total farm business profit statement shows only the total of these profits and losses, and gives no indication of whether or not each individual enterprise is as profitable as it can and should be.

Total dairy farms are seldom comparable, one with another, or from year to year for the same farm. But the dairy enterprise is common to all dairy farms and can be analyzed and compared from farm to farm and from year to year to learn how well it is doing. Sample costs, or standards, are available at some local Agricultural Extension offices, along with assistance in analyzing a dairy enterprise to improve profit. Satisfactory results in analyzing a dairy farm business ordinarily require little more than a full analysis of the dairy enterprise, although usually the forage crop enterprises need to be examined briefly for possible improvements or shifts in feed types to make a more economical forage supply for over-all greater profit for the farm as a whole. Figure 2 illustrates a dairy farm business with a dairy and four crop enterprises.

WHAT CONSTITUTES THE DAIRY ENTERPRISE?

the dairy herd is the enterprise

The dairy enterprise is composed of the dairy herd, including milking cows, dry cows, bulls, and young dairy stock being raised for replacement or sale. The average cow for the year is the producing unit, and total enterprise figures are divided by the average number of cows to obtain per cow figures for analysis.

Income. The dairy enterprise income is from milk, dairy stock, and manure sold and used on the farm.

Costs. These are for stock, feed, labor, miscellaneous items, depreciation on dairy buildings and equipment, and interest on investment in the dairy enterprise. Inventory increases or decreases are taken into account in figuring both income and costs. Purchased feed is charged to the dairy at cost at the dairy. Farm-grown feed is charged by quantity at farm value. Hired labor is charged at cost, and operator's and family labor is charged at about the same rate, for actual labor performed in and for the dairy enterprise. The operator's labor will vary widely from farm to farm, depending on its size and whether he works largely in the dairy, on crops, or devotes most of this time to management, which we do not include in the labor.

Earnings. For comparability, both in the enterprise and for the farm business as a whole, earnings are figured at three levels, each of which has certain advant-

Table 3: Sample Dairy Enterprise Income and Expense 130-Cow Grade A Dairy—San Joaquin Valley, Selling 10,000 Pounds of Milk per Cow

Income	Per cent	Quantity		Price	Total value	Per cow	Per cwt milk
		Total 130 cows	Per cow				
Milk sold, class I	50	650,000	5,000	$ 5.25	$34,125		
Milk sold, other	50	650,000	5,000	3.25	21,125		
Total milk sales	100	1,300,000	10,000	$ 4.25	$55,250	$425.00	$4.25
Cows sold		33	0.25	$135.00	$ 4,455		
Dead cows sold		2	0.02	1.00	2		
Small calves sold		70	0.54	12.00	840		
Other stock sales		3	0.02	100.00	300		
Total stock sales					$ 5,597	$ 43.05	$ .43
Manure sold or to crops		432 T	3.3	$ 1.00	$ 432	$ 3.32	$ .03
Total income (A)					$61,279	$471.37	$4.71
Expense							
Concentrates bought		169 T	1.3	$ 70.00	$11,830	$ 91.00	
Hay from farm		409 T	3.1	22.50	9,203	70.79	
Silage from farm		360 T	2.8	8.00	2,880	22.15	
Pasture on farm, AUM		1,113	8.6	7.50	8,347	64.21	
Total feed, T hay equiv. and feed cost		1,237	9.5		$32,260	$248.15	$2.48
Labor		7,800	60.00	$ 1.25	$ 9,750	$ 75.00	$0.75
Tractor and truck work		330	2.54	1.11	366	2.81	0.03
Cows bought		2	.02	275.00	550	4.23	0.04
Breeding fees		140	1.09	7.00	980	7.54	0.08
Straw and shavings		42	.32	12.00	504	3.88	0.04
Taxes, dairy share					654	5.03	0.05
Cow testing					455	3.50	0.03
Electricity					360	2.77	0.03
Insurance—comp., so. sec., fire					600	4.62	0.04
Misc. other, repairs, vet., etc.					1,281	9.85	0.10
Depreciation chargeable to dairy					2,178	16.75	0.17
Subtotal all costs except interest (B)					$49,938	$384.13	$3.84
Interest on investment ($74,320 @ 5%)					3,716	28.59	.29
Total costs of production (C)					$53,654	$412.72	$4.13
Management income (A −C)					7,625	58.65	0.59
Capital and management income (A −B)					$11,341	$ 87.24	$0.87
Add estimated operator labor included in above labor cost − 1,950 hrs. @ $1.25					2,450	18.85	0.19
Farm income					$13,791	$106.09	$1.06
Net stock income—stock incomes less costs					$ 5,047	$ 38.82	$0.39
Effect of different milk prices on:							
Management income—milk at $3.25 (no class I)					−$ 5,375	−$ 41.35	−$0.41
Management income—milk at $3.75 (25% class I)					$ 1,125	$ 8.65	$0.09
Management income—milk at $4.75 (75% class I)					$14,125	$108.65	$1.09

The above is a sample calculation based upon detailed enterprise records over many years prior to 1951, but brought up to date with adjustments to current prices. It was also based on a large size, high-production level, and general high level of management and efficiency, so it may serve as a standard toward which the good dairyman should strive. It is not presented as average or typical.

ages in individual cases. **Management income** is the amount by which total income exceeds all costs of production, except management, including as costs the value of the operator's labor and interest on the invested capital. This is perhaps the best single measure of the efficiency of the enterprise. **Capital and management income** is income less all costs, except interest on investment. It may be considered as the earnings of management and capital. It is usually the most significant profit figure for the large dairyman who performs no labor. **Farm income** is the total amount the dairyman makes from his business —for his management, labor, and invested capital. In figuring it, the value of his labor and interest on investment are not included as costs. It approximates the profit as figured by a working farmer in his records. Individuals, for income tax and other purposes, figure profit in many ways so their "net profit" might or might not be comparable with one of the above terms, depending on their labor, interest on indebtedness, and use of inventory in figuring profit. Table 3 shows a sample enterprise statement for a 130-cow grade-A dairy enterprise, with assumed high efficiency and minimum costs, for 1957 conditions.

THE PROFIT FORMULA . . .

contains four profit-determining factors

This formula is defined as:

Profit = Production per cow × price of milk per hundredweight + net stock income – total expense per cow. The four profit-determining factors in the formula are:

1. Production per cow
2. Price of milk per hundredweight
3. Net stock income per cow
4. Total expense per cow

None of these factors stands alone; all are interrelated.

PRODUCTION PER COW

Higher production per average cow in the herd tends to increase profit. There are three main factors in increasing average production per cow: feeding, culling, and breeding.

Feeding and production. Each cow has a definite hereditary maximum production capacity. The extent to which her production reaches this capacity is determined by the quantity and quality of the feed received. It is profitable to feed each cow so that she can approach the highest production of which she is capable. The use of additional feed, however, would be wasteful, because it would result in accumulating unnecessary body fat that would further increase the feed required for maintenance. The use of more expensive kinds of feed than are necessary also is a waste of money.

Adequate and yet economical feeding of each dairy cow in his herd is probably the dairyman's greatest managerial problem. Its satisfactory solution is lacking in most unprofitable dairy enterprises.

The subject of feeding and costs is discussed on pages 25 to 36 under "Getting Maximum Return from Feed Costs."

Culling and production. The removal of low-producing cows from a herd increases the average production of the remaining herd. This is called culling for production, since there may be other reasons for culling, such as disease.

The testing of cows for production is prerequisite to intelligent culling for production and to maintaining a high herd average production per cow. Dairy

herd improvement associations provide this testing service in all leading dairy counties in California at costs of about 30 cents per cow per month. Knowing each cow's production enables the dairyman gradually to eliminate poor ones and replace with better ones, and to feed according to production.

It is difficult to give any definite production level at which a cow is a cull and should be eliminated. A general rule is: *any cow whose annual production does not pay direct feed and labor costs, and whose disposal would not reduce income more than it reduces costs, should be disposed of at once.* Cows that are earning a small profit and for which a better replacement is not available should be kept until the space or feed is needed for a better cow or a more promising heifer. A cow giving 200 pounds of fat might not be a cull on some dairy farms, while one giving 400 pounds might be a cull in a high-producing herd if space were needed for a cow with a potentiality of 500 pounds of milk fat.

Culling must be practical and gradual, since it is important to maintain the herd at a size that best fits available feed, labor, buildings, and equipment. It can be used as a means of keeping herd size at its best number through removal of poor animals as better ones become available.

Breeding and production. Dairy cattle inherit the capacity to attain high production. The best way to provide replacement heifers of high-producing ability, therefore, is to breed high-producing cows to bulls able to transmit high production. The breeding program and the culling program work together to produce a good herd.

The main object of the breeding program on farms that save heifer calves for replacement purposes is to get heifers with higher productive capacity than their dams. Artificial breeding with sires proved to transmit this ability is the surest way to attain higher production per cow in the future.

A second object of the breeding program is to obtain regularity and proper length of lactation periods by getting the cow with calf at the proper time. Having each cow in production from 10 to 11 months of the year will result in highest average production per cow. Cows are in milk about 83 per cent of the time in most regions in California, which is equivalent to 10 months of the year. Breeding trouble or carelessness can reduce this to 60 per cent, with corresponding loss of production and income. A breeding record of individual cows and control of breeding through confinement of bulls, or artificial breeding, are essential to regularity in the breeding program.

Another object of the breeding program is to have cows in milk at the right time of the year. Whether to have cows in milk to take advantage of natural feed or to stabilize production throughout the year, or to obtain maximum production for the year, is a decision that only the individual dairyman can make.

Fall freshening is known to result in higher total production for the year than spring freshening. The cooler weather at freshening, the tendency toward high production the first few months to carry through the winter, and good, natural spring pasture stimulating and prolonging production, combine for higher total production from cows freshening in the fall. Seasonality of production is discussed under price of milk.

PRICE OF MILK PER HUNDREDWEIGHT

Milk prices are largely determined by supply and demand conditions off the farm, or, in the case of milk used for market milk and cream, are set by a state agency. The individual dairyman can influence his price only through his choice of market or manufacturing milk,

his selection of a channel of sale, the quality of his product, and the seasonal distribution of his production. His location within the state will also affect his outlets and price.

Market-milk prices. Market milk brings higher prices than manufacturing milk. Currently, milk distributors pay for market milk for class-1 uses—market milk and cream — at a considerably higher price than for the milk used for other purposes. Most market milk is sold from producers to distributors on a contract basis which specifies a minimum quota or percentage that must be paid for at class-1 prices. There is quite a wide range in these contracts. An old patron in some areas may have a contract as high as 80 or 90 per cent of production. A new patron to obtain a market may take one with no guarantee or with one as low as 10 per cent. These are minimums, however, and distributors pay for as much as they need to meet their class-1 requirements. The sale contract can be the grade-A dairyman's most important price and profit determining factor. To obtain and retain a market-milk contract, he must produce clean milk of good flavor. To obtain his best price under a contract, he must maintain the production specified, particularly in the fall, which frequently determines his quota for the following year. Calculations at the bottom of Table 3 show the effect of per cent of class-1 milk on earnings.

Manufacturing-milk prices. These are determined more by national than by local conditions. The prices of manufactured dairy products are reflected in prices paid to dairymen by local creameries producing one or several products. Prices vary seasonally, being lower in the summer than in the fall and winter. The price the manufacturing-milk producer receives at his farm may vary slightly with his choice of plant to which he sells. His average annual price will vary somewhat with the seasonality of his production. Quality is becoming more important and in some places a premium is available for milk in refrigerated bulk tanks.

With prices averaging a little over $3.00 per hundredweight the last three years, it is difficult for manufacturing-milk producers to make a fair return for their management labor and invested capital. In areas of higher land values and costs, resulting from more profitable alternatives, this kind of dairying will probably shift to market milk or discontinue. It can continue in areas of lower land values and forage costs, with natural and irrigated pasture as the main forage. It can be fairly profitable there only with the best of management. Table 10 on page 36 illustrates such an enterprise.

Seasonality and price. For every region and every type of product there is a seasonal-production pattern that best fits local feed and marketing conditions and results in the greatest profit.

The market-milk producer needs even production throughout the year. He can improve his average price by adjusting level of production through the year to market demand, thereby avoiding a seasonal surplus to be sold at the lower manufacturing-milk price.

Prices of both market and manufacturing milk are usually higher in the fall and winter than in the spring. By freshening more of his cows in the fall, the dairyman will have a larger proportion of his production in the fall and winter months. This, plus the fact that fall-freshened cows give more milk and more milk fat, will make fall freshening profitable. Where bad winters are not a handicap, and irrigated pasture is available for late summer and fall feed, as in the valley regions, fall freshening could increase profit by several dollars per cow.

There are feeding problems associated with seasonal production which the dairyman must consider when determin-

ing the most profitable policy for his farm. Fresh, high-producing cows require almost twice as much feed as dry cows. If spring produces a high surplus peak of natural pasture, that is the time to have the herd milking heavily. Some market-milk producers may find it profitable to have a spring surplus, even though this excess production over a base quota brings the manufacturing-milk price. This is an individual problem, requiring careful analysis. Table 2 shows seasonality of production in the six dairy regions of California.

NET STOCK INCOME PER COW[1]

Most dairy enterprises include the raising and selling of some dairy stock. How many and what kinds of animals should make up the herd, which calves are to be raised for use in the herd, or later sale, and which should be sold soon after birth are important considerations in dairy farm management. Over the years, enterprise records have shown higher profits associated usually with higher net stock income.

In most herds, where replacements are raised, practically all of the heifer calves of good breeding are raised, so that adequate replacements to maintain high production will be available. Purebred or registered animals may be raised to take advantage of prices substantially above those paid for grade stock. In most herds an occasional purchase of outside stock is necessary in the breeding and replacement program. Sales of stock, however, usually exceed purchases, and result in a **net stock income.**

Net stock income is the value of stock produced over the cost of stock bought and the death losses and decline in value of stock in the herd. The formula for net stock income may be stated as below.

Net stock income is not a profit from raising dairy stock since costs of production are not considered and would be difficult to segregate from costs of milk production. Where replacements are purchased and no stock is raised in the enterprise, as in some corral dairies around Los Angeles, purchases exceed sales, leaving a net stock cost instead of a net stock income. A sample herd composition and computation of net stock income is shown in Table 4.

Heifers for replacements. The maintenance of a herd of milking cows with satisfactory production requires the replacement of about one out of four, or 25 per cent, of the average number of cows each year. Death losses average about 2 per cent and culling for production and disease will remove the other 23 per cent. The figures vary widely from year to year and from herd to herd, but these figures are a rough guide to replacement needs. Corral dairies in Southern California, where replacements are purchased as cows, have a much higher replacement requirement, usually from 30 to 50 per cent.

By this method, cost for each replacement is the difference between cost of the replacement cow delivered to the ranch, and the sale value, usually for beef, of the cull cow being replaced. Where calves are raised, the costs of replacement are included in feed and other enterprise costs.

The cost of raising dairy heifers varies widely with the different feeds used, the feed prices, time required, and bull service chargeable to the heifers.

For a manufacturing-milk dairy farm in a region of low hay and pasture costs, dependent largely on pasture, the esti-

---

[1] Net Stock Income = total sales of dairy stock – total purchases of dairy stock + increase or – decrease } in stock on hand as shown by annual inventory.

Table 4: Herd Composition and Sample Stock Sales 100-Cow Herd Maintained Largely with Replacements Raised in the Dairy Enterprise

	Dropped, bought	Died	Sold	No. period	Av. no. year	A.U. per hd.	Total A.U.	A.U. per cow
Bulls	..	..	..	1	1	1.00	1.0	0.01
Cows	2	2	25	100	100	1.00	100.0	1.00
Calves to 3 months	90	4	56	32	8	0.25	2.0	0.02
Calves 3 months to year	..	1	1	29	21	0.40	8.4	0.08
Heifers 1 to 2 years	..	1	1	27	27	0.70	18.9	0.19
Heifers 2 to 2⅓ years	..	..	1	26	9	0.75	6.8	0.07
Total			84		166		137.1	1.37

Computation of net stock income	No. head	Av. price	Total value	Per cow
Cows sold, culling about average	25	$130	$3,250	$32.50
Calves sold, surplus not raised	56	8	448	4.48
Heifers sold, usually some not wanted	3	100	300	3.00
Total sales	84		$3,998	$39.98
Less: cows bought, usually have to buy a few	2	$275	550	5.50
Net stock income	82		$3,448	$34.48

This sample calculation illustrates what could and would result under good management in just maintaining a dairy herd. Although actual herds may increase or decrease in a year, no inventory change is assumed here. It would, however, affect both herd composition and net stock income in an actual case. A good basic high-producing herd using artificial breeding is assumed, although one bull is shown for occasional use in line with usual practice.

mated cost of a two-year-old bred heifer is about $200. An additional four months before calving would add $35 to her cost.

On a market-milk dairy, under probable higher cost conditions and on irrigated pasture, the estimated cost of the two-year bred heifer is about $210. Another four months before calving would add $45 to these costs. It is an economy to feed heifers well for maturity and freshening at two to two and one-half years of age.

Bulls. The bull has two functions in the herd: 1) to breed the cows for calves and milk; and 2) to produce superior heifer calves to maintain or increase average production per cow.

The cost of service from an owned bull is usually an unsegregated part of dairy enterprise expenses. Cost is composed of two parts: 1) maintenance, including feeding, housing, and care of the bull; and 2) ownership, including depreciation and interest on the investment.

Dairy bulls are kept in individual pens and, although they may occasionally receive a little pasture, they are fed largely hay. One dairy bull in a year would probably require six tons of hay, and about 40 hours of labor for feeding, cleaning the pen, and other tasks. At $22.50 a ton for hay, and $1.25 an hour for labor, these costs would total $185. To this may be added about $10 for miscellaneous costs and $25 for housing. This brings the annual maintenance cost of the bull to about $220. With an average of one bull to about 30 cows, bull maintenance costs about $7 per cow. This is the part of cost considered as chargeable to milk production.

Ownership costs may vary widely with purchase and selling price of bulls. A $500 bull sold three years later for beef for $250 would show an annual depreciation of $83 a year, and interest of $18 on the average investment would bring total ownership cost to $100 a year. Combining the two costs and functions gives an annual cost of $320 a year per bull. This amounts to a service cost of $10 each for 32 cows.

This high cost of breeding with owned bulls shows the economy of obtaining artificial insemination where available at a reasonable cost and in a satisfactory manner. Better and more expensive bulls can be used for artificial breeding and still result in a lower cost per cow than under individual ownership, since more cows can be served. The average number of cows bred per bull in all artificial breeding associations in the United States in 1956 was 2,174.

A dairyman can well afford to pay more for service from an outstanding bull that has proved his ability to transmit high production. Artificial breeding with semen from bulls that have been proved to increase production in daughters over their dams is now available in most dairy areas in California. Fees vary around $8 per cow. This system of breeding cows is successful and sound and has been increasing rapidly in California. About 30 per cent of the dairy cows bred in the state in 1956 are estimated to have been bred artificially.

Bull calves for veal. Surplus dairy calves are sometimes raised for veal on manufacturing-milk dairy farms, or by a few farmers who buy them for this purpose. True veal is produced mainly on whole milk without supplement of grain or hay at a requirement of 10 pounds of milk to a pound of gain. Ordinarily only calves with high birth weight justify this high-cost feeding and then, only when veal is high in relation to milk. A 90-pound calf requires 600 pounds of milk to reach a good marketable weight of 150 pounds. With milk worth $3.15 per hundredweight, the milk would cost about $19 which, plus a few dollars for labor and other costs, and initial value of the calf, would bring a cost at marketing time of $30 or more —over 20¢ a pound.

Dairy stock for beef. It rarely pays a dairyman to raise steers of dairy breeds for beef. Feeds and facilities on a dairy farm are usually more profitably employed in milk production and for raising heifers for replacement purposes. Where a farm has surplus low-cost pasture, it would pay to raise a few of the surplus male calves for beef. Holstein steers make economical gains on pasture, and although they bring less per pound, they cost less to start with than a beef calf. In many other countries more attention is paid to meat production from dairy and dual-purpose animals.

Purebred stock. The raising and selling of purebred stock is sometimes not as profitable as it would appear to the outsider. Milk is still the major part of the income on such farms, and production must be higher than in grade commercial herds to justify the breeding and registration program and to cover its higher costs. In California during 1956, average production of milk fat per cow was 32 pounds higher for purebred than for grade cows. Income over feed and milking costs at about $1.00 a pound of fat would be $32, so would more than cover the higher costs on purebred cows.

Dairymen with good, high-producing herds, including registered cows, do have an opportunity for some constructive breeding. They may have the satisfaction of producing at a good profit some outstanding animals of high value. The increased use of artificial breeding has reduced the market for purebred bulls, and requires, instead, bulls of greater promise of transmitting the high production potential.

WHAT STOCK SALES MAY BE EXPECTED?

Dairy stock raised and sold varies widely from herd to herd and from year to year. Where most of the replacements are raised in the herd and a few additional animals are raised for sale or to increase the size of the herd, the net stock income will vary from 5 to 15 per cent of the total income of the dairy enterprise and will average around 8 per cent over the years under varying price conditions.

In Holstein herds, where replacements are raised and where cull cows weigh 1,200 pounds, the net stock income will be equivalent to the value of 330 pounds of the cows sold—about $36 a cow when cutter and canner cows bring 11 cents a pound. The raising of additional stock will increase this amount. With lighter breeds having cows of 900 pounds, net stock income will be equivalent to 250 pounds of cull cow value. Variation in prices of beef and the value of dropped calves that can be raised for veal cause variation in net stock income from year to year. See Table 4 for an illustration.

TOTAL EXPENSE PER COW

In determining profit in dairying, expense is as important as income. Some dairymen fail to obtain good profits because costs are higher than necessary. On the other hand, some practice false economies, such as inadequate feeding, with resulting low production and income.

In general, it is profitable to provide all the feed, labor, and facilities essential to high production, but to do it in the most economical manner possible.

A discussion of the major expenses involved in dairy farming may reveal what economies can be effected. These major expenses are feed, labor, miscellaneous costs, and overhead. Feed is the item in which skillful management will show greatest reduction of costs. It will be discussed last and at some length. The budget in Table 3 shows sample costs in some detail.

HERD SIZE IN RELATION TO COSTS

Recent upward trends in size of dairies show that adjustments have been taking place to maximize efficiency and profit. More cows milked with existing facilities usually result in lower overhead and labor cost per cow. In corral dairies, where all feed is purchased, some owners use shifts of milkers, with cows brought in and milked in many groups almost around the clock. The important factor here is to have management competent to handle such a large and complicated business.

On dairy farms where forage is produced for the dairy enterprise, adjustment of herd size to the best combination of produced and purchased feeds, dairy facilities, and labor supply is an important managerial problem. Homegrown hay, silage, and pasture are usually lower in cost of nutrients to the dairy enterprise than purchased hay. Many dairy herds have become larger than can be fed on the pasture and other forage on the farm, with the result that average feed costs have been increased. This could be carried to the point where profit per cow is reduced and even to where total profit from the greater number of cows might be lower than with a smaller number of cows to fit the more economical supply of forage production on the farm.

Where milkers are hired, it is important to have a balance between the number of milkers and the size of the herd. A skilled milker handles about 60 cows twice a day with the bucket-type milking machine, and 75 or more with a pipeline milker. With about 80 per cent of the cows in the herd milking most of the time, a herd of around 80 average cows for one milker, or 160 for two, would seem to be maximum. To allow for relief milking and emergencies, and a more comfortable work load for

all concerned, a two-milker herd of from 130 to 150 average cows is recommended. Calculations show it provides most of the economies of large size. This seems to be the size toward which most grade-A dairies are trending. Going beyond this in additional steps depends on the managerial ability of the operator, as well as the size of the farm and its financing.

For any particular operator and farm, there is probably a size that will best fit his resources and ability and be the most profitable, whether it is 10 cows or 300. Although equipment costs per cow are higher for 10 cows producing manufacturing milk than for more cows, 10 cows can be more profitable if this number is just right to use low-cost pasture and available family labor that cannot be more profitably employed. It could be that putting this same forage through eight higher-producing cows might be more profitable. The important step is to analyze the farm business and plan the dairy and forage enterprises to fit best the goals and resources of the family. The Agricultural Extension Service offers help upon request. Once the best size has been determined, it is important to work toward that level but with revisions to fit changing conditions.

LABOR COSTS

Dairymen in recent years have had to meet increasing labor costs and difficulties in obtaining competent milkers. A few have gone out of business for this reason. Some have met this problem by better management in size of herd, providing facilities and obtaining higher production per cow, so that output per worker has increased and labor cost per hundredweight of milk has not increased in amount or in per cent of total costs. It may even show a slight percentage decrease with the substitution of higher overhead costs on the newer equipment.

The most recent dairy-management study records in the San Joaquin Valley in 1950 showed 77 hours of labor per cow for the year in market-milk enterprises averaging 63 cows. Manufacturing-milk dairy records in Humboldt County for the four years (1949-1952) averaged 58 hours in dairies with 39 cows. A dairy labor survey in Southern California in 1951, based on a typical day, showed an annual labor input of 62 hours per cow in 116 dairies averaging 220 cows. Five dairies in Marin County averaging 155 cows showed 59 hours per cow in 1955. These figures cover total labor in the enterprise—milking, feeding, and raising replacements, except that in Southern California few calves were raised.

On a large two-milker, grade-A dairy with good buildings and a pipeline milker, 60 hours of labor per cow in the dairy enterprise is suggested as attainable. That figure is used in the sample budget in Table 3.

The Dairy Labor Survey in Southern California in 1951 showed the following milking time per 1,000 pounds of milk: with bucket-type machine 5.1 hours, pipeline machine 4.0 hours, hand milking 10.5 hours. The pipeline milker showed a saving of 20 per cent in milking time, but only 2 per cent in total labor in the enterprise. Larger savings are shown now. Practically all milking is now done by machines on commercialized dairy farms in California. The 1954 agricultural census showed 17,224 farms from which some milk or cream was sold, and 15,766 farms having milking machines.

Compared with other states, California, with its mild climate and its freedom from a long winter feeding period under shelter, has a lower labor requirement in dairying. Large size of business and the more specialized nature of our dairy farming also contribute to this advantage. But labor cost is still a major item in the dairy enterprise. In our earlier dairy-management studies, it was around 25 per cent of the total production cost. More recently, it was around 20 per

cent. In the production cost survey by the Bureau of Milk Control for the second quarter of 1957 in the northern San Joaquin Valley, it was 17 per cent of the total cost, but this is for milk production alone and does not cover raising replacements. Labor is 18.5 per cent of total costs in our sample budget in Table 3.

A cost of this magnitude offers opportunities for important savings. They are being made through better buildings and equipment, and arrangement of lanes, corrals, and feed bunks, with increased use of mechanical feeding and self-feeding. The smaller walk-through milking barn or parlor handling 4 to 12 cows at a time involves less labor than the conventional stanchion barn handling several times as many cows. By a system of remote controlled gates and ramps, cows come to elevated stalls around the milker in some of the modern milking parlors, thus saving the time of the milker and minimizing the area to be kept clean. Cows on good irrigated pasture nearby usually take less time than all-corral feeding. Good labor relations will result in obtaining and holding competent workers. This also will help to attain lower labor costs.

MISCELLANEOUS COSTS

This group of expenses in the dairy enterprise covers quite a range of items —breeding fees, veterinary service, dairy supplies, repairs, electricity and fuel, cow-testing dues, truck and tractor work for the dairy enterprise, insurance and taxes on the dairy buildings, equipment, and stock. This group came to $40 a cow in our sample budget, which is somewhat below average, which we believe will range between $40 and $50 a cow in market-milk dairies. These are essential costs, and largely beyond the dairyman's control. Good management and size of business can keep expenses to minimum essentials, but skimping on needed supplies, disease control, and testing cows for production would be false economy.

REPLACEMENT COSTS

The purchase of cows and other stock for herd replacements is handled differently in private accounting systems. In some, it is considered capital outlay when purchased, and annual depreciation is taken until the purchased cows are sold, at which time a capital gain or loss is computed for income tax purposes. Cows raised in the herd may also be handled as capital items having no initial cost, since the costs of raising them have already been included in expenses. But, for analyzing dairy enterprises and comparing them with others, we have found it simplest and best to use a stock inventory in figuring profit, and to consider all sales of cows and other stock as income, and all stock purchases as expense.

Where most of the replacements are raised in the enterprise, sales of cull cows and other stock will usually exceed the cost of dairy stock bought, and will result in a net stock income discussed on page 17 and illustrated in Table 4. Where replacements are purchased and calves are not raised, the cost of cows bought will exceed the income from those sold, thus resulting in a net stock cost which, for all practical purposes, may be considered as the replacement cost.

If the enterprise illustrated in Table 3 were a corral dairy with all replacements purchased at in-line prices, the net stock or replacement cost would be about $33 per cow instead of a net stock income of $35; and feed cost, through eliminating the raising of replacements, would be about $33 per cow lower, thus reducing earnings by about $35.

In the cost surveys of the Bureau of Milk Control, replacement cost is one of the items of cost, since these costs cover the production of milk only, and replacement cost is figured, with local variations, by taking the value at freshening

of replacements raised, plus the cost of those purchased, and less the income from cows sold. In the first half of 1957, these came to about $35 per cow in market-milk dairies in the San Joaquin Valley, and about $40 per cow in the metropolitan area of Los Angeles and Orange counties.

OVERHEAD COSTS

Overhead costs of depreciation and interest are not large items. To have good stock and adequate facilities is an advantage, but a dairyman's financial strength can be weakened by heavy debt for nonessential facilities. The best way to hold capital outlay to the minimum is to obtain the minimum essentials in the most economical manner possible.

Too much equipment or building area increases labor of maintenance. A small milking barn can accommodate many cows by several successive turn-ins. A lower investment is required for the storage and handling of hay and silage when maximum use is made of pasture.

With modern equipment at 1957 prices, investment and depreciation are considerably larger than on existing dairies equipped formerly at lower prices and now largely written off through depreciation. Table 5 shows a sample investment for two dairies. The 130-cow grade-A dairy with 216 acres of crops is the basis for the sample budget in Table 3 and the enterprise illustration in Figure 2. The 30-cow manufacturing milk investment is at minimum levels at current prices. It forms the basis for estimated sample costs shown for the small manufacturing milk dairy referred to in Table 10 on page 36.

Depreciation is that portion of the original cost of buildings and equipment chargeable to each year of use. There are several ways of estimating it for each item. In the straight-line method, ultimate salvage value is deducted from the original cost, and the remainder is divided by the expected years of useful life. For example, the two-unit bucket-type milking machine costing $450 might be assumed to have no salvage value and be usable for twenty years. This would result in an annual depreciation of $22.50. It is customary to depreciate better-type buildings over a thirty- or forty-year period, more temporary buildings over twenty years, and dairy equipment from five to twenty years. Depreciation in the 130-cow dairy investment in Table 5 was based on years of life from ten to thirty years for various items, and came to $16.75 per cow, or about 4 per cent of the total cost of production. The investment in dairy facilities for a 100-cow enterprise would be almost as large as for 130 cows, with a resulting depreciation of $18 a cow. This illustrates one of the savings made possible by using facilities to capacity.

In private accounting and for income tax purposes, depreciation may be taken on purchased cows. In this case, it is the difference between cost and selling price divided by the usual period such cows are kept (from two to five years). In our analysis of dairy enterprises we seldom figure depreciation on cows since we use the stock inventory in which cows are maintained at an average value through new cows coming in and old ones going out. Methods can be varied to suit individual circumstances. In a new enterprise started with purchased cows, depreciation on them would be taken. Later, when the herd is being maintained by raising replacements, depreciation would be offset by appreciation of young stock being raised, and would be reflected only in the inventory valuations.

Interest on investment is a proper part of the cost of production. It represents the wage or cost of capital used. In analyzing dairy records, it should be considered since, in some cases, capital in labor-saving facilities is a substitution for part of the labor that would be needed. We have figured sample costs here at 5 per cent of the average value

Table 5: Sample Dairy Enterprise and Dairy Farm Investment for 130-Cow Grade A and 30-Cow Manufacturing-Milk Dairy Farms

	130-cow, grade A			30-cow, mfg. milk		
	Quan.	Total	Per cow	Quan.	Total	Per cow
Land in lots and corrals	4 A	$ 2,000	$ 15.38	1 A	$ 400	$ 13.33
Dairy buildings and improvements						
Milking barn and milk house	6-stall	$ 8,000	$ 61.54	8-stall	$ 1,400	$ 46.67
Feed and shelter barns and other buildings	....	14,400	110.77	.....	1,400	46.67
Bunker silo	400 ton	2,000	15.38		.....	.....
Corral fences, gates, feed bunks		1,400	10.77		200	6.66
Paving in lots and lanes	6,000 sq ft	2,000	15.38		.....	.....
Milkers' or help cottages	2	6,000	46.15		.....	.....
Water and liquid waste disposal systems		2,200	16.93		600	20.00
Total original cost, dairy bldgs., etc.		$ 36,000	$ 276.92		$ 3,600	$ 120.00
Dairy equipment						
Milking machine, pipeline, bucket type	6 unit	$ 4,500	$ 34.62	2 unit	$ 450	$ 15.00
Milk cooling and holding tank	1,300 gal	6,000	46.15	Cans	125	4.16
All other dairy equipment		2,000	15.38		275	9.17
Total original cost, dairy equipment		$ 12,500	$ 96.15		$ 850	$ 28.33
Average investment in feed on hand		$ 4,000	$ 30.77		$ 800	$ 26.67
Average investment in dairy herd including young replacement stock with cows at $250		42,600	327.69		9,500	316.67
Total dairy enterprise invest., orig. cost		$ 97,100	$ 746.91		$15,150	$ 505.00
Average dairy enterprise investment*		72,850	560.38		12,925	430.83
Average annual depreciation, dairy facilities		2,178	16.75		175	5.83
Additional for farm producing all of forage						
Land	216 A	$108,000	$ 830.77	52 A	$20,800	$ 693.34
Farm buildings, fences, irrig. system		33,000	253.85		2,800	93.33
Farming equipment		21,800	167.69		5,950	198.33
Total original cost farming facilities		$162,800	$1,252.31		$29,550	$ 985.00
Average investment in farming enterprises*		135,400	1,041.54		25,175	839.17
Total depreciation farming enterprises		2,876	22.12		465	15.50
Total dairy farm investment—cost basis		259,900	1,999.23		44,700	1,490.00
not including dwelling—average value*		208,250	1,601.92		38,100	1,270.00

* Average investment includes depreciable buildings and equipment at half of original cost.

of facilities and other capital invested in the enterprise. The average value of buildings and equipment is estimated at half the original cost, since such assets depreciate from cost to zero over their period of use. Note that our sample interest in Table 3 comes to $28.59 per cow, or about 7 per cent of the total cost.

In private accounting, interest on indebtedness is an expense, whereas interest on the investment by the operator is not. The dairyman with no debt and no interest to pay will recognize that part of his earnings is a return to him for his invested capital. He will do well in his business and financial management to estimate his investment and earnings thereon, and figure the rate from year to year. After deducting from his profit an allowance for his labor and management, he will find his rate earned on investment may be from nothing to as high as 15 per cent. His management has to be fairly good to earn 5 per cent, which is about the maximum he could average in other investments.

GETTING MAXIMUM RETURN FROM FEED COSTS

requires analyzing costs and feeding practices

Feed cost for both purchased and farm-grown feed is from 50 to 70 per cent of the total expense per cow. This cost group offers great opportunity for false economy, sound economy, or extravagance. A study and analysis of feeding practices and costs are the dairyman's most important device in improving his profit by either: 1) reducing costs without reducing income; or 2) considerably increasing his income without greatly increasing his costs.

RELATIVE VALUE OF DAIRY FEEDS

For management purposes, it is convenient to consider feeds in five main types: concentrates, hay, silage, green feed (or other succulent feeds), and pasture. All can be used and at least two are needed, but to some extent one can be substituted for another on the basis of availability and relative cost. To do the best possible job in providing an adequate supply of feed at the lowest cost, you must understand how these feed types vary in nutrient content and cost of nutrients, and how you may substitute or use one in place of another.

Total Digestible Nutrients (TDN). This is the net digestible portion of a feed available for growth and production. It is a measure of the energy content of carbohydrates, proteins and fats, usually expressed as a percentage of the feed. Table 6 shows the average TDN content of the main feed types and the resulting cost of 100 pounds of TDN at typical prices of that feed. It also shows conversion factors for use in substituting one feed for another.

Feed quantities. Feeds are measured and sold by weight in pounds or tons. For convenience, we use tons. An exception is the pasturage eaten by an animal which is not weighed but is rented or sold at a certain price per head month. Animals of different size vary in the feed eaten, so a standard unit for pasturage is used—the **Animal Unit Month** (AUM). That is the amount of feed required by one mature head of cattle in one month. It is further defined as containing 400 pounds of TDN or equivalent in nutrients to 0.4 ton of hay. Table 4 shows the animal units per head for different age groups.

Hay equivalent. Another convenient measure of total nutrients is the ton of hay equivalent. It means just what it says—the equivalent in total nutrient content to 1 ton of hay which, roughly, contains about 1,000 pounds of TDN.

Table 6: Nutrient Content and Sample Costs in Five Main Dairy Feed Types

	Concentrates	Hay	Silage	Fresh green feed	Irrigated pasture
Per cent of total digestible nutrients	75	50	16	14	....
Pounds of total digestible nutrients in 1 T or AUM	1,500	1,000	320	280	400
Quantity equivalent to 1 T of hay	.67 T	1 T	3.1 T	3.6 T	2.5 AUM
Sample farm price or value per ton or AUM	$70.00	$22.50	$ 8.00	$ 6.00	$ 7.00
Cost per 100 lbs of TDN at above farm value or cost	$ 4.67	$ 2.25	$ 2.50	$ 2.14	$ 1.75
Cost per ton of hay equiv.	$46.90	$22.50	$24.80	$21.60	$17.50

With an AUM containing 400 pounds of TDN, 2.5 AUM are needed to furnish the same quantity as a ton of hay. Table 6 shows hay equivalent factors for the other feed types. To convert a certain number of AUM's of pasture to hay equivalent, you divide that number by 2.5 or multiply by 0.4. These conversions are useful in dairy farm management in adding up all feed used to see how it compares with the feed probably needed, and also in taking a total annual feed need and breaking it down into the most economical proportion of feed types, both grown and purchased. Table 7, which shows feed quantities per head, shows forage in tons of hay equivalent which is in addition to the concentrates shown.

Concentrates. Grains, seed meals, and similar materials of high feeding value are called concentrates. Total digestible nutrient content varies from a high of around 81 per cent in some grains down to a low of 60 per cent for some byproducts, such as molasses. It probably averages around 75 per cent for the materials used in feeding dairy cows and in the mixed concentrates sold by feed mills. This feed group is the most expensive source of nutrients, so is used only to the extent needed to accomplish two purposes. One is to bring up the protein level in the entire dairy ration, where nonlegume forage furnishes most of the TDN, and the other is to furnish additional nutrients in a concentrated form, so that high-producing cows can consume enough feed to reach their maximum production. Since nutrients in concentrates cost from two to three times as much as in hay and pasture, their level of use has been one of the most important profit factors in the dairy enterprise.

Hay. This is the main feed type for dairy cows in California. Most of it is alfalfa, which is or can be of high palatability, as well as adequate in protein and mineral content. Modern methods of mechanized harvesting have made its production possible in areas where it is a profitable crop, and from which it may be transported for use in other areas. Most hays vary around 50 per cent TDN. Although it is slightly higher in nutrient cost than irrigated pasture and considerably higher than natural pasture, the ease with which hay may be stored and transported and, hence, its availability everywhere the year round make it the basic dairy feed. Even stock on irrigated pasture still needs and receives some hay for greater consumption and better handling of nutrients.

Silage. Cut green forage preserved with some fermentation in upright, trench or bunker silos, with as much air excluded as possible to promote preservation is called silage. Silage can be

made from several crops, but corn and sorghum are used most often. Some silage from alfalfa, and mixtures such as oats and vetch or grasses and clovers are being successfully made and used. Silage is used either in the belief that it adds succulence to an otherwise dry ration and results in better production, or where it can be grown and stored more economically than hay and, therefor, may be substituted for much of the hay. With modern mechanical equipment for harvesting, storing, and feeding, and with economical horizontal silos, its use is increasing. Tests and experience have shown that satisfactory results can be obtained on dry feed only, without silage or other succulent feeds, provided the ration is well balanced and of adequate nutrient and vitamin content. But many dairymen have found that they can get better production on their farms through the use of pasture and silage than of hay alone. Every farm is different, and the dairyman will do well to adopt the plan best fitted to his conditions.

Green feed. In recent years, some fresh chopped green feed from alfalfa or grass and legume mixtures has been given to cows in corrals to replace pasture. The forage chopper and power-feeding wagon have made this relatively easy and attractive, and more feed and milk per acre have resulted. Our few cost analyses have generally shown that "green chop" delivered to the cows costs more than nutrients gathered by the cows in the pasture. Some dairymen found this to be true and discontinued the practice. No doubt, on some dairy farms this practice would be more practicable and profitable than pasturing or feeding all hay. A large, well-managed business and feed crops such as alfalfa that do best under mechanical harvesting are essential for best results. Careful calculation of alternative costs should furnish the correct answer.

Other succulent feeds occasionally used in dairy feeding are cull lettuce and carrots, pea vines, pumpkins, and stock beets grown for this purpose. But these are relatively unimportant in total, and are used only in a few situations where they contribute a small portion of the total feed at a lower nutrient cost.

Pasture. Where it can be produced on the dairy farm, pasturage is usually the most economical of the feeds available. The cows walk to the feed, do their own harvesting, and spread most of the manure, thus saving labor and machinery operating costs. Dairy-management studies over the years prior to 1951—when they were discontinued—usually showed that dairies using the most pasture had more profit per cow. Recent cost calculations on different feed types are now showing that irrigated pasturage costs more to produce than was previously believed, so the margin of advantage for irrigated pasture over the other forage types is not so great. On good crop land, with yields of 12 to 15 animal unit months of feed per acre in a season of eight to ten months of use, costs can be as low as $6.00 an AUM, or $1.50 per 100 pounds of TDN, as compared with alfalfa hay at $20.00 a ton under the same conditions, or $2.00 per 100 pounds of TDN. But few dairymen do so well in their pasture management, and some will find their pasturage costs to be almost as high as with hay or silage. Lower cost irrigated pasture will be found on shallower soils unsuited to alfalfa and other crops.

Natural pasture is cheaper than irrigated pasture and other feeds. It is widely used in season for heifers and dry stock and, to a considerable extent for milking herds in coast counties such as Sonoma and Marin, where spring grazing is good but where there is little or no irrigated pasture. The natural feed is good, however, for only about four months, so its use requires considerable dependence on hay and silage the rest of the year. Pasturage, whether natural

or irrigated, can always contribute to lower feed costs with proper management. It will have to be the main feed in manufacturing milk production.

GOOD MANAGEMENT IN FEEDING

In feeding the dairy herd, the following items should be noted as aids in attaining high production at minimum cost:

1. Furnish enough feed, so that cows can reach their maximum production and young stock can make normal rapid growth.

2. Use the maximum possible of the lowest-cost feeds, such as pasture, and then furnish other feeds such as hay, silage, and finally concentrates to make the total supply adequate.

3. Be sure the quality of the ration is adequate, with sufficient protein, vitamin, and mineral content, and that it contains no harmful substance.

4. Feed concentrates only as they are needed by individual cows to enable each to reach maximum production, and use the kind that will do the job at lowest cost.

5. Figure your total feed use per cow each year, and compare it with standards to discover waste or underfeeding.

Adequate feed. The feed, and its essential components required daily by animals of different ages and production levels, has been experimentally determined, and is available in the form of feeding standards in several publications on this subject. For example, the Morrison Feeding Standard[1] recommends for a 1,100-pound cow giving 40 pounds of 3.5 per cent fat milk a day a daily ration containing 2.5 pounds of protein and 20 pounds of TDN. Of this quantity, about 40 per cent is for maintenance of the cow and 60 per cent for the milk produced. Feed required for individual animals varies according to weight and production level. In group feeding, animals are generally given all the forage they want, this supplemented by feeding individual cows concentrates according to their current production level. No doubt, some get more or less total feed than they need.

Will a herd with a certain average production per cow have an average feed requirement per cow equal to that for a cow of that production level? Many dairy-management study records obtained by the Agricultural Extension Service partly answer this question. In lower-producing herds, it was found that total computed TDN use per cow-year was not much above that recommended for a cow of average production. At higher-production levels, the excess feed over theoretical requirement becomes greater. Figure 3 shows the relation between feed use and herd average production levels, and includes a line showing the feed recommended per cow for different production levels. At 400 pounds of fat per cow, use was 11 per cent over theoretical need. Waste and overfeeding would easily account for the difference. Naturally, there was some variation between individual dairies, but in practically all cases, the feed reported was within 10 per cent above or below the top line in the chart on page 29. This chart also shows the division of nutrients from concentrates and forage; it also shows that concentrates make up a larger portion of total feed as higher production is obtained. The chart can be used to check the feed use in an individual dairy for adequacy or waste.

FEEDING CONCENTRATES ACCORDING TO PRODUCTION

The main purpose of feeding concentrates is to provide each cow with nutrients adequate in quantity and quality to maintain production at the maximum level of which she is capable. Cows producing 25 pounds of milk fat a month, or 250 pounds a year, can obtain all the nutrients needed from roughage if given all the good hay and pasturage they will eat. But cows capable of producing

[1] Morrison, F. B., Feeds and Feeding, 20th ed., pp. 1004-5.

USE THIS CHART TO CHECK OR ESTIMATE FEED USE FOR THE YEAR

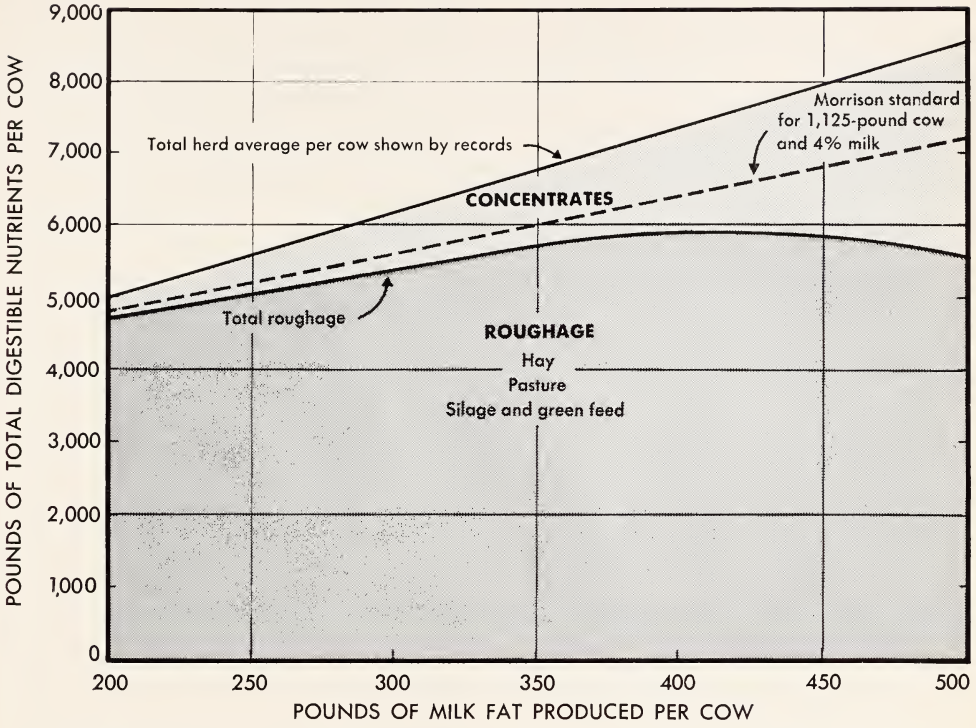


Fig. 3. Pounds of total digestible nutrients used per cow for the milk fat they produced (herd average) in San Joaquin Valley dairies.

HOW TO USE THE CHART

Locate your annual herd average production per cow along the bottom line. Draw a perpendicular line to the top line marked "Total herd average per cow shown by records." Read the pounds of TDN horizontally opposite that point on the scale at left of the chart. This is the average pounds of total digestible nutrients normally used per cow for cows in herds with your average production.

To compare this quantity that is normally used per cow with what was actually used, you will need to compute your actual use in pounds of TDN per average cow. Proceed as follows:

1. Compute total use in one year in tons and AUM's for each feed type.
2. Convert to total pounds of TDN by factors in Table 6.
3. Add feed types to get total pounds of TDN.
4. Figure probable use by stock other than cows, using probable use per head shown in Table 7.
5. Subtract above to get feed use by cows only.
6. Divide above total by average number of cows.
7. Compare above result with need from chart above.

more than 30 pounds of fat a month may not be able to hold sufficient bulky roughage to furnish enough nutrients to maintain high production. Therefore, it is necessary to vary concentrate feeding with the production of each cow.

Two guides for feeding concentrates according to production have been used in California. The first method, which is well established, results in rather high concentrate feeding at low-production levels. Liberal feeding at low-production levels aids in building up the physical condition of cows for the next lactation period. A second method has been devised wherein no concentrates are fed at the lowest levels of production, but the increase is faster as production rises. (See Table 7.) In using either method, the physical condition of each cow should be carefully observed and the quantity of concentrates adjusted accordingly.

Method 1. Divide the number of pounds of milk fat produced monthly by five. The quotient is the number of pounds of concentrate to feed daily. As production declines with advance in the lactation period, the quantity of feed declines, and usually no concentrates are given when the cow is dry. When concentrates are high in cost in relation to roughage, divide by six. If very cheap, divide by four.

Method 2. Subtract 25 from the pounds of fat produced per month, and divide the remainder by two to arrive at the pounds of concentrates to feed per day. This rule puts heavy feeding where it belongs—with heavy production. It removes all concentrates from the ration of extremely low producers. It approximates actual practice, as shown in the chart.

In all concentrate feeding according to production it is frequently necessary to vary from the rule or standard followed. Young, small, first-calf heifers may need concentrates even below the 25- to 30-pound production level. When roughage quality is poor, more liberal feeding and a better concentrate mixture may be required. This general principle of feeding individual cows according to production has been well demonstrated to result in higher average production with lower concentrate use and lower feed costs.

In most herds, particularly those where concentrates are fed by hired labor, it is desirable to set a maximum quantity to be fed to any cow. This may vary with feeding practices and costs but, in most instances, not more than 12 to 14 pounds should be fed, even to a cow showing extremely high production.

Selection of concentrates. The second purpose in feeding concentrates is to cover any deficiencies in the ration as a whole—protein, minerals and, in rare cases, vitamin A. Where the roughage is largely alfalfa hay with some pasture or silage, the ration will contain enough protein, carotene, and minerals. The concentrates fed in addition would be needed only to furnish the additional nutrients for individual high-producing cows, so could be ordinary ground grains or a prepared low-protein dairy concentrate mixture, which costs less than one with a higher protein content. If, on the other hand, roughage is largely

Table 7: Feeding Concentrates According to Production

Production per cow in pounds of milk fat			Pounds of concentrates per cow daily	
Daily	Monthly	10 months of the year	Method 1 P* / 5	Method 2 P*—25 / 2
0.8	25	250	5.0	0.0
1.0	30	300	6.0	2.5
1.2	35	350	7.0	5.0
1.3	40	400	8.0	7.5
1.5	45	450	9.0	10.0
1.7	50	500	10.0	12.5

* P — production per month in pounds of milk fat.

low-protein hay and dry-grass pasture, concentrates should provide the needed additional protein, minerals, and perhaps vitamin A or carotene.

CHECK UPON FEED USE

Checking the actual feed used in a dairy herd against some kind of standard or average has been found helpful in discovering overfeeding and waste, underfeeding, or nutritional difficulties. Table 8 is presented as a suggested standard of comparison of feed use for animals largely of the Holstein breed. Smaller animals will run a little less. The feed inputs shown for cows are based on the same data as those used for Figure 3—actual use in many dairy enterprises over the years as obtained in dairy-management studies in the San Joaquin Valley.

To make this comparison, you need a fairly accurate idea of the following:

1. Average number of cows for the year—count once a month or get from DHIA record.

2. Number of bulls and young stock fed through a period or for a year—from occasional counts and memory.

3. Total quantity of each feed type used during the year.

(a) Concentrates — add up feed tags.

(b) Hay grown plus hay bought corrected by inventory of hay on hand at beginning and end of year.

(c) Silage — tons on hand, plus those put up during year, less on hand at close gives actual use — by measurement and counting loads.

(d) Pasturage — record of actual use by age groups for each kind of pasture each month, or estimate of probable production for each field or type of pasture based on remembered use.

4. Pounds of fat produced per cow — from DHIA record of figured from sales.

With the above information, the rest is simple arithmetic illustrated below.

Table 8: Feed Use per Head in Commercial Dairy Herds

	Period fed	Pounds of TDN		Quantity for period	
		Av. per day	Total for period	Tons conc.	Forage, tons hay equiv.
Calves to 3 mo., not incl. milk	3 mo.	3.0	270	0.08	.15
Calves 3 mo. to year	9 mo.	6.6	1,815	0.08	1.70
Heifers 1 to 2 years	1 yr.	9.2	3,358	0.06	3.27
Heifers 2 to 2⅓ yrs	4 mo.	13.6	1,659	0.06	1.57
Heifers 2 to 3 yrs	1 yr.	13.2	4,800	...	4.80
Bulls	1 yr.	16.4	6,000	...	6.00
Cows by production (lbs fat):					
250	year	15.3	5,600	0.10	5.45
300	year	17.0	6,200	0.50	5.45
350	year	18.6	6,800	0.90	5.45
400	year	20.2	7,400	1.22	5.57
450	year	21.9	8,000	1.50	5.75
500	year	23.6	8,600	1.80	5.90

The above feed use is typical of dairy animals of the larger breeds and somewhat above the Morrison standard, to allow for a little waste. For cows it approximates the use shown in Figure 3. Feed shown for calves is in addition to milk. The last section shows total feed for the period as usually divided between concentrates and forage, with the latter in tons of hay equivalent.

That shows the computation of total pounds TDN in feeds used, computation of pounds of TDN probably used by stock other than cows. Subtract this from total use to obtain use by cows, divide by average number of cows to get pounds of TDN used per cow, and compare that result with the pounds from Figure 3 for per-cow use at that production. Another way would be to figure the total TDN needed for all stock, including cows, and compare it with total TDN used. This is for total feed. A calculation of the pounds of concentrate used per cow should also be made and compared with the suggested quantity in Table 8. Here is where the greatest waste or extravagance is usually found in dairy enterprises analyzed in recent years.

Dairy cows in California are usually fed a concentrate mixture of ground grains, grain products, dried beet pulp, and oil cake meals. A few dairymen buy the ingredients and mix their own concentrates. With local ground barley the main ingredient the resulting mixture can be economical. A leaflet entitled "Concentrate mixtures for dairy cows" by G. E. Gordon, is available from local or campus offices of the Agricultural Extension Service of the University of California.

In recent years, dairymen have purchased largely mixed concentrates from feed companies, delivered, and placed in a bin by a bulk truck. These concentrates save on the cost and handling of sacks and considerable labor in handling and feeding on the farm. Feed companies offer several dairy mixes with a crude protein content of from 12 to 18 per cent. In figuring to balance your roughage with adequate protein, remember that this crude protein is not all digestible. The digestible protein shown in feeding standards runs around 75 to 80 per cent of the total crude protein. This whole subject of feed quality, analyses, and figuring balanced rations is an extensive one treated in books and other publications. It can be important to dairymen who are finding difficulty in reaching a high efficiency in milk output from feed use.

Example: Feed used in 130-cow herd with average production of 400 pounds of fat per cow:

1. Computation of total pounds of TDN actually used.

Concentrates	169 tons @	1,500 lbs TDN	253,500
Hay	409 tons @	1,000	409,000
Silage	360 tons @	360	129,600
Pasture	1,113 AUM @	400	445,200
Total lbs TDN used			1,237,300

2. Computation of TDN probably used by stock other than cows (Table 6)

1 bull @ 6,000 lbs per head	6,000
38 calves to 3 months @ 270	10,260
36 calves 3 months to year @ 1,815	65,340
34 heifers 1 to 2 years @ 3,358	114,172
33 heifers 2 to 2⅓ years @ 1,659	54,747
Total pounds TDN not cows	250,519

3. Subtract "not cows" from total to get pounds TDN for cows only: 986,781
4. Divide by 130 cows to get lbs per cow 7,591
5. Shown by Figure 3 or Table 8 7,400
6. Difference — insignificant 191

GOOD FORAGE AT LOW COST

Forage furnishes most of the feed used in the dairy enterprise, and its cost can greatly influence profit. As previously stated, pasture, where possible, is usually the lowest cost source of nutrients, followed by hay, green chop, and silage, but with the order of the last three varying from farm to farm. We cannot say what proportion of the total forage should be from each type on dairy farms in general, or on any individual farm without considering the facilities or resources available.

The corral dairy in a metropolitan area is usually limited to hay bought from distant producing areas. Farther out, where there are some farming possibilities, some of these dairies may use a little irrigated pasture or green chop and silage to supplement purchased hay, even though its production may result in nutrient costs as high as in the hay they buy. The success of many corral dairymen shows that it is possible to feed the milking herd on hay and concentrates only.

In farming areas on good soil with a wide range of available crops, high land values, taxes, irrigation water, and other costs may result in production costs of irrigated pasture, alfalfa and silage crops high enough to offer no advantage over purchased hay. Some dairymen here have switched to corral feeding of hay and other feeds purchased from off the farm. Some might do well to move to an area better suited to dairy farming.

There are still large areas in the San Joaquin and Sacramento valleys where, because of the soil or climate, dairy farming with some to all of the forage grown on the farm will pay as well or better than cash crop farming. Whether to grow or buy forage is an important managerial decision that should be based on factual information and calculated alternative budgets. Local farm advisors of the University of California Agricultural Extension Service have considerable information on local inputs and costs. They can help in analyzing a dairy farm business and in developing a plan for furnishing the needed forage.

Table 9 presents a sample calculation of typical forage production costs under three sets of conditions, all assuming adequate size of business, owned equipment, and good management. Natural pasture and oat and vetch hay are shown for lower value nonirrigated land, such as that found in the central and north coast counties. Irrigated pasture on shallow soil suited to no other crops is the second set of conditions typical of some areas in the Sacramento and San Joaquin valleys. The third set of conditions represents costs as they might occur on good valley crop land for irrigated pasture, alfalfa hay, and corn silage. These costs are not presented as average, but are within the range of observed costs. Actual or estimated costs on the particular farm should be used in deciding what to grow or whether to buy instead.

TO BUY OR TO GROW FORAGE

Whether to dairy largely with purchased forage, as in a corral dairy, or to have more land and grow one's own is an important question to some people. Dairying formerly was largely based on all feed being grown on the farm. It was a means of selling additional labor and management along with the production of the land in the form of milk. This is still done on some farms. Then, as specialization increased, dairies became larger and concentrates were purchased. Now, some specialize only in milk production on a corral dairy, and buy all their feed. Each dairyman must consider several factors before making his decision. Location may be the controlling factor in some cases, and the land and its alternative uses in others.

The cost of hay or pasture to the dairy enterprise should be considered as the

Table 9: Sample Production Costs of Forage Crops

	I Nonirrigated land		II Shallow land	III Good irrigated valley land		
	Natural pasture	Oat and vetch hay	Irrig. pasture	Irrig. pasture	Alfalfa hay	Corn silage
Good-crop yield, tons per acre	....	3.0	.....	....	6.0	20.0
Pasture, AUM per acre	2.0	0.6	12.0	14.0	1.0	....
Production costs per acre						
Man labor at $1.25 per hour	$0.25	$ 8.38	$16.00	$ 16.00	$ 29.38	$ 37.50
Tractor work at $1.00, $2.00, cash costs	0.15	8.45	2.00	2.00	15.70	26.30
Forage harvester and misc.	....	1.00	....	....	2.00	2.50
Total labor and field power	$0.40	$17.83	$18.00	$ 18.00	$ 47.08	$ 66.30
Irrigation water at $2.50 per A ft.	....	....	12.50	12.50	10.00	6.25
Seed, fertilizers and misc.	1.00	12.00	10.00	11.00	16.00	20.00
General expense	.07	1.49	2.03	2.08	3.65	4.63
Repairs and insurance	.10	2.00	1.00	1.00	4.00	4.00
County taxes on land	1.50	3.00	4.00	6.00	6.00	6.00
Subtotal cash and labor costs	$3.07	$36.32	$47.53	$ 50.58	$ 86.73	$107.18
Depreciation—Alf. or past. stand	....	....	5.00	6.00	12.00	....
Fences, irrig. system and other	0.50	0.80	2.31	7.00	7.00	7.00
Farming equipment	0.10	8.00	3.65	4.00	6.00	9.00
Subtotal cash and depreciation	$3.67	$45.12	$58.49	$ 67.58	$111.73	$123.18
Interest on investment at 5%						
Stand, improv. and equipment	0.70	2.70	3.78	4.80	5.60	8.00
Land	3.00	7.50	20.00	30.00	30.00	30.00
Total cost of production	$7.37	$55.32	$82.27	$102.38	$147.33	$161.18
Less value of by-product pasture	....	2.40	....	....	7.00	....
Net cost of production per A	$7.37	$52.92	$82.27	$102.38	$140.33	$161.18
Cost per ton or AUM	$3.69	$17.64	6.86	7.31	$ 23.39	$ 8.06
Cost per 100 lbs of TDN	$0.92	$ 1.76	$ 1.72	$ 1.83	$ 2.34	$ 2.24

"farm value," i.e., what it could be sold for on the farm to outsiders, less marketing cost. The cost of purchased hay is the cost delivered to the farm—usually from $1 to $3 per ton more than the farm value of the hay grown on the farm. If it costs several dollars more a ton to grow the hay than the "farm value" which you should charge the dairy, you would lose money on your hay crop. If this continued to happen year after year, it might be advisable to use the land for a more profitable cash crop and buy hay. Our observations and calculations lead us to believe that a dairyman in an area suited to dairy farming will make more from his labor, management, and invested capital if he depends largely on home-grown forage. He can use pasture, the cheapest feed. He avoids losses in periods of high prices for purchased hay.

A dairy farmer with a certain limited area may expand his dairy enterprise to more cows than can be fed on the pasture and other feeds produced on his farm. If he has a good herd, it may pay to enlarge it and to buy the additional hay required. This has been done successfully by many dairy farmers. They increase the use of their dairy facilities and hired labor with enough economies to more than offset their increased feed cost and thereby improve total farm profit. On the other hand, they might increase their worries and costs and be worse off than with their original small herd and lower expenses. It is a matter calling for careful analysis by the individual.

A farm on shallow soils suited mainly to irrigated pasture is limited to that forage crop. In this case, the place would be largely in irrigated pasture. Hay and other feeds needed to supplement the pasture and replace it in the winter would be purchased. Dairying would probably continue to be more profitable for such a farm than feeding beef cattle or lambs, the only other alternatives.

BUYING FEED

Wise buying of the feed required is an important profit factor in dairying. Mixed concentrates in bulk by truck loads are usually bought at current market price, as used through the year. There is no opportunity to take advantage of the season "lows" in grain prices, and buy then to store for future use. Only the large farm with storage, grinding, and mixing facilities would save enough by seasonal buying and home mixing to justify buying under current conditions. In all buying, however, money may be saved by taking advantage of competitive prices for concentrates of the quality and kind required.

If much hay is purchased, it should be bought where and when the quality of hay wanted is usually cheapest; this is during the harvest season when the hay can be trucked from field to buyer without intermediate handling or storage. In most years, price savings would be enough to cover the additional cost of insurance and storage on the farm and of the credit required to make the large outlay for the year's supply. It is good business to borrow when the use of capital makes possible savings greater than the credit cost. Such loans can be repaid as the hay is used instead of taking current income to buy hay at increasing prices each month.

Many dairymen have observed that the quality of the hay affects the quantity eaten and the results obtained. It is said that cows do not necessarily follow market grades or prices in their preferences. Some dairymen make it a practice to buy carefully after inspection, or through a dealer, or from a producer who meets their specifications. There are also opportunities for the large dairyman to haul his own hay from producing areas and, thus, to avoid the margins taken by dealers and truckers. Some own farms there, and others have arrangements to buy from farmers.

item by item—a help toward profits

We have now discussed in some detail most of the individual cost items in the dairy enterprise, with particular attention to feed quantities and costs. Analyzing the dairy enterprise means making a detailed study, item by item, of inputs and production, and prices, income, costs, and profit. By such analysis, items will be discovered that are more or less than they should be, so that changes can

Table 10: Sample Dairy Enterprise Income and Expense for a 30-Cow Manufacturing Milk Dairy in an Irrigated Valley with a Sale of 10,000 lbs of Milk per Cow

Income	Quantity		Price	Total value	Per cow	Per cwt milk
	Total 30 cows	Per cow				
Milk sold—lbs	300,000	10,000	$ 3.25	$ 9,750	$325.00	$3.25
Cows sold	8	0.27	163.75	1,310	43.67	.44
Other stock sold, calves, heifers	15	0.50	27.33	410	13.66	.13
Manure to crops	90 T	3.00	1.00	90	3.00	.03
Total income				$11,560	$385.33	$3.85
INPUTS AND COSTS						
Concentrates	32 T	1.1	$ 70.00	$ 2,240	$ 74.67	....
Hay, from farm	74 T	2.5	21.00	1,554	51.80	....
Irrigated pasture—AUM	466.5	15.5	7.00	3,266	108.86	....
Total feed cost				$ 7,060	$235.33	$2.35
Labor—presumed all operator	2,100	70.0	$ 1.00	2,100	70.00	.70
Breeding fees	33	1.1	7.00	231	7.70	.08
Tractor and truck costs to dairy	60 hours	2.0	2.00	120	4.00	.04
Taxes, dairy share				150	5.00	.05
Cow testing dues				120	4.00	.04
Electricity				60	2.00	.02
Insurance				15	.50	....
Miscellaneous, repairs				180	6.00	.06
Depreciation, dairy facilities (table 5)				175	5.83	.06
Interest on investment at 5%				646	21.54	.22
Total all costs of production				$10,857	$361.90	$3.62
Management income				$ 703	$ 23.43	$ .23
Capital and management income, added interest				1,349	44.97	.45
Farm income, added $2,100 operator labor				3,449	114.97	1.15
Add earnings from 52 A of alfalfa and irrigated pasture: labor 900 hrs. at $1.00				$ 900	$ 30.00	....
Interest on investment crop land, equipment, etc.				1,260	42.00	....
Maximum potential net farm income with $38,125 debt free investment and 3,000 hours of labor with good management				$ 5,609	$186.97	....

The above is a calculated set of inputs and costs based on excellent management and most favorable conditions. Earnings resulting are much above average, since few manufacturing-milk producers obtain such high production per cow and are able to sell surplus stock raised at such good prices, and to depend so largely on pasture. Actual past records, however, have shown such attainments in each item, so this is presented as a standard toward which the manufacturing milk producer may strive if maximum efficiency and profit are to be attained. The above feed use fits the crop plan in Table 11.

be made to increase future profit. Required is a statement of actual past income, expenses, and profit for a year. An enterprise accounting system which makes such statements available for all the farm business enterprises is recommended for this. Or it may be constructed by looking up items from available records, by adding purchase slips by kind, by statements covering milk sales, and by estimating and calculating other items. Although a complete statement covering all items and furnishing the profit is desirable, a partial analysis of separate items—concentrates used, labor, et cetera—is well worth while.

This dairy enterprise statement for the year can then be calculated per cow and per hundredweight of milk, thus enabling the dairyman to make comparisons, item by item, with similar statements for other farms and his own farm in previous years. The best way to discover items that are out of line is to compare them with some outside standard or published average for a group of dairy enterprises under similar conditions. Prior to 1951, we had a number of dairy enterprise-management studies with annual summaries containing group averages, which could be used for comparison in dairy-farm analysis. Now, with more limited data available, there are few schedules of inputs and costs, and most of these are unpublished, being those developed and used in dairy-farm analysis by farm advisors. The sample schedule in Table 3 for a large grade-A dairy, and in Table 10 for a small manufacturing-milk dairy, both for irrigated valley conditions, can be used in analyzing similar dairy enterprises. They can serve as guides for making up a budget or statement for an individual dairy enterprise elsewhere, although costs and feeds used would be different.

Whether the dairy enterprise is large and justifies separate consideration in accounting and management, or is a part of a small specialized dairy farm, a careful analysis and checking of items will usually disclose some means of improving profit under prevailing conditions. The most important step is to keep records and to have the information for making the many decisions required during the year. Then, once a year take a look at these records and see how you have done, consider major changes or policy decisions, make tentative plans, and try them out on paper with estimated budgets. Many dairymen who know from experience the right thing to do are successful without this special effort, but to achieve maximum earnings and efficiency requires additional effort in the form of records, analyses, and planning.

PLANNING THE DAIRY FARM BUSINESS . . .

herd, feed, labor should be in balance

A well-organized dairy-farm business is one where herd size is fitted to the amount of feed that can be produced most economically on the farm, and where labor supply, buildings, and equipment are fitted to the size of the herd. Production of roughage on the farm is the most important consideration, since farm-grown forage is usually cheaper than feed purchased and transported. Ordinarily it is most profitable to keep the herd adjusted to yearly use of the pasture and other feed produced on the farm, with little roughage to buy and little surplus hay to sell. Purchase of some additional hay is justified where the farm is not suited to the production of enough to supplement the pasture

available, or where the farm is too small to furnish all the roughage for a herd that utilizes the available labor, buildings, and equipment.

SIZE OF FARM

Fit labor to size of herd. Labor on a large dairy farm may be more profitably adjusted to the herd than can the herd be adjusted to number of workers. On smaller farms, however, it might be more desirable to adjust the size of the herd to utilize fully the one or two men available. The minimum-sized herd for a sideline enterprise on a general farm or a fruit farm should be about 10 cows. Fewer cows would not require much less time nor justify a milking machine and place in which to milk.

The one-man dairy farm. A specialized dairy farm for the support of a single family and with one principal worker should have 20 to 60 cows. Where both pasture and hay are produced, 20 to 30 cows would keep one man fully employed and furnish a living. On such small farms, haying may present some difficulty, so a single worker may prefer to buy hay and have more pasture and more cows, in which case he can handle 30 to 40 cows. In the dry-lot dairy, where all feed is purchased and delivered, a man can handle 40 to 60 cows.

The two-family dairy farm. A dairy farm justifying the full-time services of two men is more efficient and less confining than a one-family unit. The nature of the work practically requires two workers, so that one can relieve the other in illness or for days off. With two men available for putting up hay and silage with modern forage harvesters, this size farm would require no additional seasonal labor.

The 50- to 60-cow dairy farm with 50 acres of irrigated pasture and 25 acres of alfalfa can be handled efficiently by two men. Either man should be able to do the milking while the other could do most of the irrigating and farm work. The herd is large enough to justify the best of equipment and yet small enough for the owner to know his cows and to feed and have them bred individually for best results.

A dairy farm of this kind should provide a comfortable living for the two workers and their families. The two workers can be partners, a father and son, or an owner and employee. The two-family farm is suggested as the minimum goal of all dairy farmers. It provides easy transfer from one generation to the next by supporting father and son during an overlapping of active years.

Larger farms. A larger dairy farm business than the above two-family farm offers some additional savings through the use of dairy facilities by more cows, with resulting lower overhead and labor costs. It also offers a greater opportunity for the gainful employment of more capital and managerial ability on the part of the owner, who may wish to devote more time to management, and hire most of the labor. The 130-cow dairy illustrated in Table 3, with the investment shown in Table 5, would be a minimum size for an owner-manager who confines his labor to small jobs and relieves or occasionally helps his full-time farm hand and two milkers. With all forage produced on the farm, some additional help would be hired for haying and filling the silo, and perhaps at other times.

The advantages of this size of business —a four-man dairy farm—are no doubt responsible for the recent marked trend toward 100- to 150-cow dairies in most of the market-milk producing areas. Growth has naturally resulted from good owner-management. As the farm business grows bigger, management also becomes more important, calling for greater ability and more time.

Beyond this size of around 130 cows, the additional economies are not large, and the managerial problems increase

through greater dependence on hired labor and hired supervision or management. Also, the opportunity to use pasture and farm-produced forage crops declines. There are a few dairies with several hundred cows, but most of these are corral fed on purchased feed.

BALANCE STOCK AND FEED PRODUCTION

In planning or reorganizing a dairy farm, it is necessary to consider the soil and the roughage that can be produced. Alfalfa requires a deep, permeable soil and adequate irrigation. Irrigated pasture may be produced economically on shallower and denser soils, but it requires considerable water and frequent irrigation. Oats and vetch for hay or silage may be produced on a wide range of soils, and in alternate years with summer fallow in regions of low rainfall without irrigation. Rolling lands not suited for crop production may be used for natural pasture. Since pasture is the most economical source of nutrients, it should receive first consideration in land use, up to the point where the maximum amount usable by the dairy herd is provided.

MAKE A CROPPING PLAN

The first step in planning the dairy farm is to decide on the acreage of each feed crop and to estimate the expected production. Each field or area is listed with its crops, acreage, probable yield per acre, and probable total production of crop and pasturage. Table 11 illustrates such a cropping plan and shows how the total feed production is compared with a feed requirement of a 30-cow herd based on the sample in Table 10, shown on page 36.

PLAN PASTURE FOR LONGER SEASON

Pasture is the cheapest of dairy feeds, and its production and feeding require the least amount of labor. But it is also the most difficult to have in the correct amount throughout the year. Careful planning and the use of several kinds of pasture can extend the season of use

Table 11: Sample Crop and Feed Production Plan for a 52-Acre Irrigated Valley Dairy Farm

Field no.	Crop or land use	Acres	Yield per acre		Total production		
			Hay tons	Pasture AUM	Hay tons	Pasture AUM	Total tons hay equiv.
1	Alfalfa, 1st year	2.5	5	1.0	12.5	2.5	13.5
2 & 3	Alfalfa, 2d and 3rd yr	5.0	6	1.0	30.0	5.0	32.0
4	Oats and vetch for hay	2.5	3	...	7.5	....	7.5
4	Sudan (2d crop)	(2.5)	..	6.0	...	15.0	6.0
5	Irrig. pasture, 1st yr	6.0	1	8.0	6.0	48.0	25.2
6–10	Irrig. pasture, older	30.0	..	12.0	...	360.0	144.0
11	Oats and vetch	6.0	3	...	18.0	....	18.0
11	Sudan (2d crop)	(6.0)	..	6.0	...	36.0	14.4
Total production		52.0			74.0	466.5	260.6
Forage needed 30-cow herd					73.0	466.0	259.8
Difference					1.0	0.5	0.8

The above illustrates how with good farming one man can produce the forage needed by a 30-cow manufacturing milk herd on 52 acres of irrigated land. It is a very close fit and requires good pasture management to produce and utilize the feed shown.

Table 12: Animal Unit Months of Pasture per Acre by Months

	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total AUM
Irrigated permanent pasture, southern California	.6	1.0	1.5	1.7	1.8	1.4	1.4	1.2	1.3	1.4	1.1	.6	15.0
Irrigated permanent pasture, central valley	.1	.4	.8	1.2	2.0	1.8	1.6	1.3	1.2	.8	.6	.2	12.0
Barley for winter pasture	.5	.6	.7	1.0	.2	....	....	....	....	....	....	....	3.0
Barley for grain	.4	....	....	....	....	....	.4	.4	....	....	....	....	1.2
Natural range, average	....	.1	.2	.3	.1	.1	....	....	....	....	....	....	1.0
Good range near coast	.1	.2	.3	.4	.5	.3	.1	.1	....	....	....	....	2.0
Sudangrass, irrigated	....	....	....	....	....	1.0	1.5	2.0	1.0	.5	....	....	6.0
Sudangrass, nonirrigated	....	....	....	....	.5	1.0	.7	.4	.3	.1	....	....	3.0
Reasonable need per cow*	0.5	1.0	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.0	0.8	0.6	13.0

* A herd in which adequate replacements are being raised will contain from 1.35 to 1.5 animal units per cow and can use around 1.3 animal unit months of pasturage per cow each month. A reasonable standard, however, would recognize the need to do with less in the winter, therefore 13 animal unit months of pasture per cow per year is a good goal.

and provide occasional pasture in the winter. Table 12 shows the pasturage obtainable by months from several types under good conditions.

Production and months of use vary considerably from place to place and from year to year, with variations in weather and management. On any farm with considerable pasture, dry or irrigated, there will usually be a surplus in the spring and a shortage in fall and winter. Cutting a crop of hay from part of the irrigated pasture in the spring will reduce the surplus peak. Having plenty of pasture will permit an extension of its use into early winter. Alfalfa and crop fields can provide a little occasional pasture during the winter. Barley planted especially for pasture provides economical winter feed.

HOW MUCH PASTURE?

It would be ideal from the cost and the nutrition standpoint to have as much pasture as could be used by the herd every month of the year. But some reduction in winter is inevitable. Some hay will be required for bulls all through the year, and a little for the cows and other stock even when abundant pasture is available. Pasturage can probably be used, up to 13 animal unit months per average cow for the cows and young stock usually in the herd. Even more can be used in the manufacturing milk herd where production can be more seasonal to fit the pasture season.

The last line in table 12 shows a reasonable pasture requirement totaling 13 animal unit months of pasturage per cow for the year. Good yields of irrigated pasture in Central California are about 12 animal unit months of feed per acre per year, but yields over 20 have been obtained. Hence, where irrigated pasture is available, one acre or more should be provided per average cow. Poorer-yielding irrigated pastures would necessitate more acreage per cow.

Nonirrigated natural pasture is not

Table 13: Sample Pasture Plan for a 52-Acre, 30-Cow Valley Dairy Farm

Field no.		Acres	AUM per acre	Animal unit months of pasturage produced												Total AUM
				Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1	Alfalfa, 1st year	2.5	.8	..	..	..	..	..	..	..	..	..	1	1	..	2
2	Alfalfa, 2nd year	2.5	1.2	1	..	..	..	..	..	..	..	..	..	1	1	3
3	Alfalfa, 3rd year	2.5	.8	1	..	..	..	..	..	..	..	..	1	..	..	2
4	Sudangrass	2.5	6.0	..	..	..	..	..	2	4	5	3	1	..	..	15
5	Irrig. pasture, 1st yr	6.0	8.0	..	..	..	..	..	8	10	9	8	6	5	2	48
6–10	Irrig. pasture, older	30.0	12.0	3	12	24	36	60	54	48	39	36	24	18	6	360
11	Sudangrass	6.0	6.0	..	..	..	..	..	6	9	12	6	3	..	..	36
Total				5	12	24	36	60	70	71	65	53	36	25	9	466
Maximum usable 30-cow herd				41	45	52	60	64	65	64	62	56	52	48	42	651
Difference—shortage or surplus				−36	−33	−28	−24	−4	5	7	3	−3	−16	−23	−33	−185

The above calculation illustrates the monthly availability of pasture in the cropping plan in Table 11. The maximum pasturage usable by a herd averaging 30 cows for the year includes that for calves and replacement heifers. Since this is for a manufacturing-milk herd, where seasonality of production is not objectionable, most of the cows are assumed to freshen in the spring and to take as high as 1.3 AUM of pasturage per head for a few months after freshening. Culls are largely sold in early winter, so feed needed in the winter for fewer and dry cows is lower than in the pasture season when most of the cows are in milk and there are over 30 cows in order to average 30 for the year. The above is a satisfactory fit, since the cropping plan provides enough hay to cover the shortage of pasturage from November through April.

only lower in yield of pasturage but is of high quality only a small part of the year. It can furnish most of the roughage for the milking herd for four or five months in the spring, although dry and young stock can get part of their feed from it during the rest of the year. Dairies with only natural spring pasture can use about 8 AUM per cow during a year. Near the coast, where good natural pastures produce two animal unit months of pasturage per acre, four acres would produce that much. Under less favorable conditions it might require as many as six or eight acres. A standard recommendation is four to six acres of good natural pasture per average cow for dairy farms with natural pasture. Additional pasturage on crop fields, or on a small irrigated pasture, would be desirable.

PLANNING THE YEAR-ROUND PASTURE

A pasture plan, estimating the pasturage available from each field and crop each month, is helpful in obtaining a maximum well-distributed quantity. Table 13 illustrates such a plan for an irrigated valley dairy farm with a 30-cow herd containing 1.35 animal units per cow.

The "maximum pasturage usable," shown in Table 13, for the herd averaging 30 cows for the year has been computed on the assumption that it was a manufacturing-milk dairy with most of the freshening in the spring to take advantage of the pasture season. It is also based on the assumption that such large high-producing cows will eat more than one AUM of pasturage per head each month and that the young stock will also eat more pasturage in spring and early summer. The fit between pasturage availability and "needed by months" is better than usual in such plans. No change seems to be called for in the cropping plan. This illustrates an important step in dairy farm management —attaining maximum use of pasture which costs less to produce than harvested forages and can be better nutritionally.

The opportunity to increase the pasturage available from a given acreage of irrigated pasture by improving yields should not be overlooked. More fields with a shorter grazing interval and longer period for regrowth usually improve total yields. In some cases, additional fertilization or improved irrigation help materially. Weed control or a change in plants through some additional reseeding may also improve the quality and quantity of forage obtained. Each of these plans should increase the pasturage.

BUYING THE DAIRY FARM . . .

Consider values, investment, credit

Going into dairy farming or moving a dairy herd to a new location involves buying or renting a farm. To most families with adequate capital, buying offers several advantages, particularly a wider range in choice of available places. With limited capital, renting offers a better opportunity to earn enough income for an adequate living and to get ahead financially. It is difficult to succeed if an attempt is made to buy, partially on credit, too small or too poor a farm in the hope of making a living, paying debts, and increasing the size of the business from earnings. Buying a farm may be the most important step taken in the lifetime of a family. It calls for the greatest care and best possible information in making the group of major decisions involved in selecting

the area, the size and kind of dairy farm, and finally, the actual consideration and purchase of the particular farm.

The first step is to learn the probable total capital required to buy and stock dairy farms of different kinds and sizes. One can then decide whether to go ahead, and what may be attempted as a reasonable initial goal. In Table 14, we present some sample investments based on new facilities at about current costs for four sizes and types of dairy farms—each a good commercial size in its class, offering an opportunity to make wages and interest at 5 per cent on the investment at current milk prices and with average management and efficiency. Some operators might not do that well, but above-average management could probably make a fair managerial income above wages and interest on investment.

The 30-cow manufacturing-milk dairy is the size we recommend as the minimum goal for a single-family dairy farm. It is illustrated by a more detailed showing of the investment in Table 5 and by the enterprise statement in Table 10. The beginner, however, should not expect to do as well as that. He might not get such good cows to start with, and might need a bigger investment. With costs of new buildings and equipment, and land at $500 an acre, the total investment shown in the first column of Table 14 is $55,550 including a small dwelling, or $1,852 a cow capacity for the entire farm. Another $8,000 to $12.000 would equip such a farm for grade-A milk production, but it is not easy to obtain a market-milk contract for such a small dairy. Distributors have a certain minimum volume they wish to pick up with their tank trucks.

The two-family farm with 60 cows and 104 acres of feed crop land is the next-sized step. It could be a manufacturing-milk dairy with about twice the investment of the 30-cow dairy, but is

Table 14: Investment in New Dairy Farm Units

	30-cow mfg. milk	60-cow grade-A	130-cow grade-A	130-cow corral dairy
Land in dairy lots at $500 an acre	$ 500	$ 1,000	$ 2,000	$ 3,000
Dairy buildings and improvements	3,600	20,800	36,000	38,100
Dairy equipment	850	8,500	12,500	12,500
Feed on hand	800	2,000	4,000	6,000
Dairy herd at start, cows @ $300	9,000	18,000	39,000	39,000
Total dairy enterprise	$14,750	$50,300	$93,500	$98,600
Land for feed crops @ $500 an acre	26,000	52,500	108,000	None
Crop buildings, fences, etc.	2,000	3,200	8,000	
Irrigation system	1,000	15,000	25,000	
Farm machinery and equipment	1,600	7,400	12,000	
Tractors, trucks, etc.	4,200	5,000	9,800	
Total crop enterprises	$34,800	$83,100	$162,800	
Owner's dwelling and grounds	6,000	10,000	10,500	12,000
Grand total farm investment	$55,550	$143,400	$266,800	$110,600
Total investment per cow	1,852	2,390	2,052	851

The above are estimated to fit the middle of a range in new investment costs for four sizes and types of dairy farms in dairy areas in irrigated valleys. Those shown in first and third columns differ slightly from the details in table 5 for the same farms as going concerns.

shown in Table 14 with grade-A facilities and an irrigation well and pipelines. This is about the minimum size recommended for a grade-A dairy because of the more expensive milking barn, milk house, and refrigerated bulk tank required. With the higher price for the product, a dairy of this size would be more profitable as a grade-A dairy. One might need to sell manufacturing milk until a contract to sell market milk is obtained. The $143,400 shown is $2,390 a cow, and covers a milker's cottage in the dairy buildings, plus one owner's dwelling as shown.

The 130-cow, grade-A dairy has been previously discussed as a good commercial size. It is illustrated by the statement in Table 3, and the investment is shown in more detail on an average value basis in Table 5. With items at new cost, total investment is $266,800, or $2,052 per cow capacity. Figure 2 further illustrates this farm. The calculations show that with the same assumptions, this dairy farm where the forage and replacement stock are produced will have a higher rate of return per dollar invested than the corral dairy in the next example.

The 130-cow, grade-A corral dairy in the fourth column in Table 14 would have an investment of around $110,000, or $851 per cow. This is without any facilities for feed production. On such a dairy, pasture would not be available, and replacements would be purchased rather than raised. Estimates of costs and income show it can be profitable with an annual capital and management return of 7.6 per cent of the average investment of $87,880, compared with the previous example with a return of 9.2 per cent on $207,340. Both of these investments are with facilities at half of new cost and do not include the owner's dwelling. Notice that the investment required for full ownership of the corral dairy for 130 cows is somewhat less than that for the 60-cow, two-family farm, where feed is grown and replacements raised. Dairymen who prefer to specialize in milk production, and have more cows may prefer this type and buy all their feed.

These four examples are only a small sample in a wide range of size, kind, and location. They are all based on irrigated valley land, and with land figured at $500 an acre, which is below current market values of farming land in the better farming areas in our irrigated valleys.

LAND VALUES

Values per acre of good farming land away from the metropolitan areas have shown the usual increases and a few declines, but a strong recent upward trend. With the index number of the value of irrigated land in California for the three years, 1947-49, as 100, this index dropped to 94 in 1950 and rose to 138 by 1956. In 1957 it was around 152. This means that land with a value of $400 an acre in 1947-49 was up 52 per cent or to around $600 in 1957. In some of the better farming areas, where land is suited to a wide range of cash crops, land values reach $1,000 an acre. There are, however, areas suitable for dairying, where land values, taxes, and water costs are more in line with what the dairyman can afford to pay.

We used $500 an acre for our feed crop land in Table 14 for two reasons —first, for uniformity in land values so that the grand totals would be comparable and show differences due to size and kind, and, second, because we believe $500 an acre is about all the dairyman can pay if he grows pasture and forage crops for his dairy herd and wishes to make good wages, a return for his management, and 5 per cent or more on his investment. We figured this for several sample budgets with a range of milk prices, and concluded that the grade-A dairyman can make his 5 per cent return from growing irrigated pasture, alfalfa

hay, and corn silage on land costing not more than $500 per acre without improvements. This could be raised by higher milk and feed values.

A similar calculation, using manufacturing-milk prices, indicates this dairyman is limited to a slightly lower wage, a lower investment throughout, and land at about $400 per acre. And that would be land in an irrigation district with ditch water where no irrigation pumping plant would be required. The sample statement in Table 10 is based on these assumptions.

A new dairy business seldom starts at full scale—too much capital is required. Sometimes the farm is inherited; sometimes it is started under a joint operating or partnership agreement, with one partner furnishing the farm or capital, and the other labor and management. Some, starting as employees, later have a chance to buy into the farm, or buy the cows and rent the farm. Some, who already have a crop farm, add a small dairy enterprise, which can grow gradually as the shift is made from cash to feed crops. Starting with heifer calves, they can raise their own cows. Some with limited capital buy a few cows and rent a dairy farm. In every case, plans and budgets based on local information will provide the best guide for decisions and for drawing up an equitable agreement.

Whether to buy an established dairy farm, including the cows, and obtain the milk contract, or to buy land and put up the new buildings can be decided only by calculating alternative costs for the farms under consideration. City people who become land owners through inheritance or investment and must decide whether to operate, lease, or sell, should also carefully consider the alternatives.

CREDIT

The dairy business is stable, offering a regular monthly cash income; credit is available toward the purchase of a good dairy farm, and additional, shorter-term credit for the purchase of cows, equipment, and even feed. But a heavy debt load is difficult to repay from earnings. Gross income must meet operating and living costs and still leave enough for debt retirement.

A potential borrower should estimate his future income and expenses carefully and avoid more debt than can easily be repaid. There will be many unforeseen expenses, but little likelihood of any unexpected additional income.

A budget test. A sample calculation will show the amount of credit that can be handled safely. Suppose a 30-cow manufacturing-milk dairy, similar to that illustrated in Table 10, were under consideration. The 53-acre farm has been found capable of producing the forage for 30 cows and replacement stock, and contains adequate buildings and a passable dwelling. The buyer has 20 cows and some heifers worth $6,500, some farming equipment valued at $3,000, and $15,000 in cash. He knows where he can buy 10 more cows for $2,500, and would need another $2,500 worth of equipment to operate the place. The farm can be bought for $40,000 without stock or movable equipment. A first-mortgage loan of $24,000 is obtainable from a good source. Obviously, the buyer needs $16,000 down payment and $5,000 more for cows and equipment. As he has only $15,000, he needs $6,000 more besides operating capital. Suppose he can borrow an additional $7,000 on cows and equipment, can he repay it? His total debt would be $31,000, some to be repaid in the near future. The total capital invested would be $54,500—with a debt amounting to 57 per cent of the total.

The budget of income and expense is calculated. It is assumed that each cow will provide 9,000 pounds of milk for sale yearly which, at $3.25 per hundredweight, gives a gross income of $8,775.

He will have little stock to sell for some years, so his total net farm income from dairy and farming amounts to only $3,609. His $24,000 amortized loan on the farm at 6 per cent requires an annual payment of $1,890 a year for thirty years. His $7,000 short-term loan repayable over five years calls for average payments of another $1,800, or so, a year. Together, these are more than his net income potential, and would leave nothing to live on. In this case, it would be unwise for him to make this purchase and assume this debt. He should continue renting in the hope of improving his net worth so that a safe purchase could be made later.

Previous calculations have shown it to be virtually impossible to repay from earnings total debts of more than half of the capital required for a stocked and equipped dairy farm. A calculation was once made of the income, expenses, and debt service charges for half the investment for a small manufacturing-milk dairy farm similar to the above for the period 1925 to 1945. It was found that in some years (particularly 1931 through 1935) net income was insufficient to cover both living costs and debt payments. Only the high prices of the war years made it possible to catch up and eventually to get out of debt. Payments on interest and principal should be kept at safe low levels, and should be sufficiently flexible to allow for higher payments in good years and smaller or no payments in bad years.

RENTING

Many California dairy farms are rented. The landlord usually furnishes land, buildings, irrigation facilities, and some nonmovable equipment. The tenant usually furnishes cows, movable equipment, and labor.

It is generally accepted that in renting, the income should be divided between landlord and tenant in proportion to their contributions, or to what they furnish and the costs they pay. The landlord's contribution is largely the use of his capital invested in land and buildings. This is converted into an annual charge by figuring interest at an appropriate rate (5 or 6 per cent) on the current valuation. Depreciation on the facilities furnished by each party may be readily estimated. The labor and management furnished by the tenant can be estimated. Other costs can be determined from past records, or may be estimated from available local information. The amount contributed by each party may then be totaled to show their costs.

Table 15 presents an illustration of the probable division of all costs between the two parties. This example is based on the 30-cow, 53-acre manufacturing-milk dairy farm illustrated also in Tables 5 and 10. Under the division of costs shown, and after deducting all of the stock sales, about a third, or 33 per cent of the total costs of the milk produced, has been met by the landlord. Hence, his proper share in the milk produced would be a third.

The landlord's total costs are $3,152, including 5 per cent interest on his investment. A cash rent of $250 a month, or $3,000 a year, would return his costs and almost 5 per cent on his investment. This is merely one of many sets of conditions. Since every farm is different, a similar calculation is suggested in all renting of farms. The parties may not follow the results of the calculation, but the information will be useful in bargaining. Each party is interested in getting as favorable a rent as possible without destroying the ability of the tenant to pay or of the landlord to furnish and maintain the farm.

FORMS OF RENT

Rent paid is usually in one of three forms: cash, share, or quantity of product.

Table 15: Sample Contributions of Tenant and Landlord for a 53-Acre, 30-Cow Manufacturing Milk Dairy Farm

	Furnished by		Total farm business
	Tenant	Landlord	
Capital invested:			
Land at $400 an acre	....	$21,200	$21,200
Farm buildings, fences, etc.	....	3,200	3,200
Dwelling	....	4,400	4,400
Equipment	$ 3,000	400	3,400
Dairy stock and feed on hand	10,300	....	10,300
Total investment	$13,300	$29,200	$42,500
Depreciation:			
Farm buildings, fences, etc.	....	220	220
Dwelling	....	220	220
Equipment	400	20	420
Total depreciation	$ 400	$ 460	$ 860
Cash costs			
Concentrates bought	2,240	....	2,240
Tractor and automobile expenses	400	30	430
County taxes	100	350	450
Insurance	20	32	52
Dairy supplies and misc. expense	600	....	600
Repairs	300	150	450
Irrigation district tax and water costs	....	520	520
Crop seeds, fertilizers and supplies	450	....	450
Subtotal cash costs	$ 4,110	$ 1,082	$ 5,192
Value of own labor and management	3,000	150	3,150
Depreciation	400	460	860
Interest on above investment at 5%	665	1,460	2,125
Total all costs	$ 8,175	$ 3,152	$11,327
Per cent of total	72	28	100
Less—stock sales, all to tenant	1,720	....	1,720
Costs of milk sold	$ 6,455	$ 3,152	$ 9,607
Per cent of total milk cost	67	33	100
Computation of income at fixed rent of 83 cwt. of milk per month:			
Income from milk sales @ $3.25 cwt.	$ 6,513	$ 3,237	$ 9,750
Income from stock sales	1,720	....	1,720
Total income	$ 8,233	$ 3,237	$11,470
Less—cash costs and depreciation	4,510	1,542	6,052
Net farm income	$ 3,723	$ 1,695	$ 5,418
Per cent of total	69	31	100

The above illustration is based on the dairy farm example for which additional details appear in tables 5, 10, 11, and 13.

Cash rent. A fixed annual or monthly cash rent, agreed upon in advance for the period of the lease, is probably the commonest form of dairy-farm rental in California. If set fairly and recognized as an average for changing price-and-production conditions over a period of years in which the tenant carries most of the risk, it is a simple, satisfactory method. It sometimes breaks down in years of low price or low production on the farm when the tenant finds it impossible to pay the rent.

This rent should be a little lower than that under a more flexible system where the landlord shares in production and price fluctuations. The sliding cash rent specifying different cash rents for different selling prices of milk or milk fat would be even better.

Share rent. Rent as a specified share of the milk income would seem fairer than cash rent, since it divides the risk of price and production variations. On dairies which are largely dependent upon rainfall for farm hay and pasture production, there are wide differences in feed production and in the cost of hay that must be bought. Where the farm furnishes the forage, one third of the milk is a common share rent; this may go up to one half where the landlord furnishes the cattle and perhaps pays part of certain costs.

The drawback to a straight share rent is that the landlord shares in the additional income from high production, heavier feeding, and better management, without making any contribution thereto. He also suffers when management is poor, when the animals are underfed, and the farm is understocked. For share renting to be fair to the tenant, the landlord should share in the purchased feed costs, perhaps in the same proportion that he shares in the value of milk produced.

Table 15 shows that the landlord furnishes about a third of the net costs of the milk produced and would, therefore, be entitled to a third of the milk. Yet the tenant stands all the costs of obtaining high production, such as furnishing superior cows and paying for all the concentrates. If the landlord paid for 40 per cent of the concentrates, it would raise his share to 42 per cent. Shifts of certain expenditures from one to the other can adjust the share to some desirable common level, such as a third or a half. It would not be wise to have the landlord share in sales of stock raised by the tenant from his own stock on the farm. There are cases where the landlord furnished the stock, and the rent came out to approximately 50 per cent of the milk and the new young stock raised.

Rent based on quantity of product. Another but less common form of rent, prevalent in Humboldt County, is the standing rent or the value of a certain quantity of milk. The farm is rated according to its capacity for a certain number of cows, and cows are assumed to have a certain standard of production. This is the rated capacity of the farm in milk. A certain proportion of this capacity, usually about a third, is considered the annual rent, and is paid monthly or in instalments at the price of milk for that month.

Under this system, it matters little to the landlord whether his tenant has high- or low-producing cows. If the tenant buys extra feed and has high production per cow or carries more cows, he does not have to share the extra income with the landlord. This system permits actual rent paid to vary with variations in price of product, but not with variations in production due either to management or to climatic conditions. This plan is probably the fairest and most satisfactory to both tenant and landlord in a region where feed production on the farm varies little from year to year. But the rating of the farm and the determining of the quantity of milk to be paid as rent must be fair to both.

In the example in Table 15, about a third of the milk produced was found to be a fair rent. The total milk produced in this case is 3,000 hundredweight (100 hundredweight per cow × 30 cows, Table 10). Hence, rent could be set at 1,000 hundredweight a year, or 83 per month, to be paid by the buyer directly to the landlord at the average price for each month. At the bottom of Table 15, the calculated net farm income of each party under this agreement is shown. The tenant receives 69 per cent of the total net farm income for the year. He furnishes 72 per cent of the costs, but he receives the use of the dwelling.

PROFIT SHARING

There are other special arrangements in which a division of income or profit from dairying is a desirable feature.

Partnerships and profit-sharing agreements sometimes involve a division of gross or net income on the basis of the inputs of each party. A wage or bonus is sometimes given to a foreman or herdsman in terms of income or profit. In a few instances, the milkers or barn crew have been paid from 12 to 20 per cent of the milk check. Where workers are paid in this manner, they may be tempted to overfeed concentrates if they are not supervised carefully or made to pay an equivalent share of the concentrate cost.

A calculation similar to that in Table 15 will be found useful in arriving at actual shares, or at an agreement for the future. If a share of gross income is involved, the person receiving that share should also share in some of the costs involved in obtaining high production.

RECORD KEEPING . . .

is extremely important to the operation

Financial, feed use, production, labor, and other records can be of great assistance in making many small day-to-day decisions, and in analyzing the business and its separate enterprises in making major ones.

In these days of intensive and highly specialized commercial farming with narrow margins between income and costs, it is becoming increasingly difficult to make a good profit. Better records are needed not only for management purposes but for reporting net income and capital gains for federal and state income tax returns. Special records are required for Social Security taxes and for refunds of taxes on gasoline used on the farm.

To obtain high and efficient production, the dairyman needs production records on each individual cow for guidance in culling, breeding, and feeding concentrates. He needs to keep breeding records to insure that heifers and cows will be bred as necessary, and that pedigree information will be retained. He needs to make periodic inventories of stock and feed on hand, and to compute feed use in order to improve efficiency. By joining a dairy herd improvement association, he will obtain some of the needed records. Additional forms and advice are available through local farm advisors of the Agricultural Extension Service.

Dairy farmers who keep their own financial records will find that the California Farm Record Book[2] will meet most of their record needs for cash incomes and expenditures by kind, capital items, depreciation, inventories, net worth statements, and profit statements

[2] California Farm Record Book, University of California, $1.00, postage and tax paid.

on both cash and inventory basis for income tax and managerial purposes.

Larger dairy farm businesses may need a full accounting system set up by a trained accountant and involving commercial bookkeeping methods. An accounting system for the farm business as a whole, plus certain supplemental records, is the minimum essential needed by the individual with a large complicated business, or where more than one owner is involved in the investment and profit in the business. Where several enterprises are involved, enterprise accounting is recommended as providing the greatest help to management. Circular 460[3] explains record needs and systems and will help you select the best way to obtain these needs.

[3] Financial Records for California Farmers, Cir. 460, University of California, free.
Both of the above are obtainable from Agricultural Publications, Room 22, Giannini Hall, University of California, Berkeley, or from local Agricultural Extension Service office.

15m 11,'58(3586)MH

Co-operative Extension work in Agriculture and Home Economics, College of Agriculture, University of California, and United States Department of Agriculture co-operating. Distributed in furtherance of the Acts of Congress of May 8, and June 30, 1914. George B. Alcorn, Director, California Agricultural Extension Service.

Consider YOUR Future in Agricultural Economics

Agricultural economics applies SCIENCE to the BUSINESS OF FARMING . . . to the marketing of farm products, to the use of agricultural and range resources.

If agriculture is to continue as an important segment of our national economy, farmers must be adequately trained in the business of farming. The University of California's course of study in agricultural economics is a step toward that goal.

The curriculum . . . presented on the Davis campus, places major emphasis on Farm Management . . . but also provides instruction in Marketing, Co-operative Marketing, Agricultural Finance, Policy, and related subjects. Supplementary work may also be taken in such branches of agriculture as Agronomy, Animal Husbandry, Pomology, Agricultural Engineering, and the like.

The faculty . . . is comprised of trained, experienced economists, many with national and international reputations in their fields. The staff is active in service and research work in all of the Western States.

Job opportunities . . . can best be understood by pointing to positions now occupied by graduates. The largest percentage are farmers. Other lines of endeavor include:

Farm Managers · Credit work · Farmer Organizations
Marketing Organizations · Agricultural Extension work
State and Federal Departments of Agriculture work
College teaching and research · High school teaching

For more information: Write to the Department of Agricultural Economics, University of California, Davis.

or: See your University of California Farm Advisor for college entrance requirements.